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A STUDY OF THE RELATIONSHIP  
BETWEEN CERTAIN VISUAL PERCEPTUAL  
ABILITIES AND ACHIEVEMENT IN  
FIRST GRADE READING

by

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A THESIS

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The undersigned certify that they have read,  
and recommend to the Faculty of Graduate Studies for  
acceptance, a thesis entitled, "A Study of the Relationship  
Between Certain Visual Perceptual Abilities and Achievement  
in First Grade Reading" submitted by Maisie Violet Wheatley  
in partial fulfilment of the requirements for the degree of  
Master of Education.



## ABSTRACT

The purpose of this study was to examine the relationship existing between certain visual discrimination abilities at the pre-reading stage and achievement in reading at the end of the first grade. Included in the visual discrimination abilities were the ability to note similarities and differences in forms and symbols and the ability to copy patterns.

The representative sample consisted of 102 first grade pupils attending three public schools in Edmonton.

Visual discrimination tests constructed by the investigator were administered in September. Gates Primary Reading Tests and the Survey of Primary Reading Development were administered in June.

Correlation coefficients were computed to determine the relationship between the visual discrimination abilities tested and reading achievement. This relationship was found to be positive with thirty-nine of the ninety-eight correlation coefficients significant at the .01 level of confidence.

When the correlations with reading ability for six form discrimination and six symbol discrimination abilities were compared the results indicated that word and letter matching ability is more closely related to reading ability than is the case for form matching ability. The results also revealed that letter matching ability had already been acquired by most pupils entering grade one.





Certain abilities involving word configurations as tested in September did not appear to be related to reading achievement in June. There was no evidence to show that the ability to remember nonsense forms for a period of one day was related to reading achievement. Although pattern copying and completion did not produce a substantial correlation with reading ability, there was a trend toward higher correlations with reading comprehension tests than with word and sentence recognition tests.

Five of the seven measures of reading ability revealed a higher correlation with mental age than with any of the form or symbol discrimination tests.

The ability to perceive reversals in words was found to have the strongest and most consistent relationship with reading ability and to have a significantly higher correlation than certain other form or symbol discrimination abilities. The ability to note minute details in words at the pre-reading stage is thus of greater importance than the ability to match forms.

Conclusions reached from the findings were that simple matching exercises are of questionable value whereas word matching exercises might be expected to aid in promoting reading readiness. Another conclusion was that it is probable that word matching techniques are developed as an intrinsic part of the word recognition program.



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## CHAPTER I

### THE PROBLEM

#### INTRODUCTION

For three decades the concept of reading readiness has been accepted as a desirable stage to be attained by first grade pupils prior to the introduction of formal reading lessons. One of the important facets of the concept of reading readiness concerns visual perceptual ability which is described as the ability to discriminate between letters and words. It has been considered essential to train pupils to make these discriminations, or to wait until the process of maturation provided for the development of this ability.

Lynn (1963) cites evidence showing that a certain degree of success in reading is possible without having reached the stage of maturation of perceptual abilities. He refers to the concept of delayed perceptual maturation as "spurious". Lynn is of the opinion that the perceptual powers of young children are underestimated and questions whether the concept of reading readiness has sufficient substance to be worth retaining. He concludes that a critical re-examination of the basis and implications of the concept is long overdue.



## BACKGROUND OF THE PROBLEM

### Visual Discrimination as a Stage in Perception

Perception has been defined by Hebb (1958, p. 179) as "the mediating processes to which sensation gives rise directly." Visual perception would then refer to the processes that determine the final response to a sensation proceeding from the organs of sight. Three fundamental stages in the process of perception are seen by Vernon (1952, p. 20). The first stage produces an awareness or knowledge that there is something in the visual field. The second stage results in an awareness that the visual stimulation is connected with some kind of an object while the third stage consists of identification and understanding of meaning. In the perception of symbolic material, Vernon points out that the identification of such material is only part of the perceptual process. The ideas suggested by the perceptual material must also be considered as part of the perceptual process. Geometrical figures and diagrams would be included with written and printed material. Concerning the perception of words Vernon notes the close connection between the auditory and visual perception arising from the origin of the word as a speech unit. Thus the perception of words is seen as a highly specialized type of visual perception.

In the field of psychology discrimination learning receives considerable attention. It is possible to train animals to select a correct response based on discriminatory ability. Much has been revealed of the nature of visual perception through experimental work





with animals or with human subjects but there remains the problem of the application of many of these findings to the process of reading.

#### Visual Discrimination as Part of the Reading Process

The reading process has been separated by Gray (1960, p. 10) into four components. These parts are:

- (1) Perception of the word
- (2) Comprehension of word and sentence meanings
- (3) Reaction to the ideas presented
- (4) Assimilation of the ideas

Gray states that word perception is "the all-important base of the reading process," and that an individual cannot comprehend or assimilate ideas unless the words which convey the ideas are identified correctly. He stresses the importance of memory for word forms and the part played by the scrutiny of word forms.

In a discussion of the principles of word recognition, Smith and Dechant (1960, p. 190) also observe that in the initial stages of instruction in word recognition, the objective is to teach the child how to look at words. These authors report that some children fail to focus on the similarities in word forms as indicated by the high incidence of reversals among words similar in form.

It may thus be concluded that the ability to discriminate similarities and differences in words is an essential part of the reading process.



## The Importance of Visual Discrimination as a Possible Factor in Reading Achievement

In the field of psychology a considerable amount of research has been devoted to the study of perception and perceptual processes. In a factorial study of perception, Thurstone (1944, p. 129) concluded that "reading is primarily a perceptual function in which the subject makes associations quickly with rapidly changing stimuli." Other studies yielded information on discrimination learning obtained by observing animals, infants and young children. The main factors studied have been light intensity, color, shape and the measurement of discrimination thresholds. Little has been done to apply these findings to the reading process where one of the earliest demands made of the child is that he be able to recognize similarities and differences in words.

In the field of reading early investigators almost forty years ago attempted to determine the relationship between the ability to discriminate between forms and symbols and later success in learning to read. Results of these early studies suggested that visual discrimination was of some importance in beginning reading. Subsequent investigations have been designed to isolate specific abilities which appear to be possible factors contributing to success in learning to read. One of the major objectives has been to determine the nature of the perceptual abilities which might be measured at the pre-reading stage to be used as a predictor of success in reading. Other investigations examined perceptual processes in reading but used as subjects older children or college students. Results thus obtained did not apply to the early stages of learning to read.



## The Need for this Study

Several visual perceptual abilities of first grade pupils have been measured before the commencement of formal reading instruction. The abilities measured and related to reading ability have included discrimination of forms, patterns, letters and words. Only a few studies have included pattern completion and pattern copying.

The most recent contribution to the research in this area was made by Justison (1963) who used four of the Bender (1938) patterns plus one additional pattern to determine the correlation between pattern copying and reading ability. No comparison was made with other types of form perception. Goins (1958) compared correlations obtained between eleven tests of perceptual ability and reading achievement. No comparison was made with symbol discrimination ability. Thus the correlation found between reading ability and form discrimination ability was not studied in relation to word and letter matching.

Similarly there exists no evidence to indicate which of several word and letter matching abilities correlates more highly with early reading ability. Although the reversal of letters and words has been studied as one of the problems in reading, no evidence is available to indicate the correlation between the ability to detect reversals at the pre-reading stage and success in learning to read.

Research studies, Gates and Bond (1936), Wilson (1938) and Durrell (1958), have indicated a positive correlation between first grade reading ability and a knowledge of the alphabet. Word and letter matching has been shown to have a low positive correlation with reading





ability Smith (1926), Gates and Bond (1936), Wilson (1938), Gates (1940), Durrell and Harrington (1955), Durrell and Gavel (1958) and Malmquist (1958). There is, however, no evidence to indicate whether there are levels of difficulty in word and letter matching and, if such levels do exist, whether the pupil who is able to perform a more complex matching task at the pre-reading stage will achieve success in first grade reading. Similarly, it has not been shown that an awareness on the part of the pupil of reversals and rotations of forms is positively correlated with his achievement in reading. Although pattern copying and pattern completion are positively correlated with reading ability, Goins (1958) and Justison (1963) no comparison has been made of these correlations and those of form and symbol matching.

#### STATEMENT OF THE PROBLEM

The problem to be investigated in this study is the relationship of various aspects of the perception of forms and symbols to reading achievement. The particular relationship to be considered is that existing between the pupil's competency in making perceptual distinctions between forms and symbols at the pre-reading stage and his success in reading at the end of the first year. The tests used to determine this relationship will be constructed in such a manner that one set of test items will be restricted to one aspect of the perception of forms and symbols. In order to compare these relationships it will be necessary to construct a series of tests which will attempt to isolate different kinds of matching abilities and levels of difficulty.



## DEFINITION OF TERMS

### 1. Visual Perceptual Abilities

For the purpose of this study visual perceptual abilities shall refer to the specific abilities measured by the tests designed by the investigator. These abilities are:

- a) The ability to distinguish between a given form and a reversal of this form
- b) The ability to distinguish between a given form and the same form rotated on an axis
- c) The ability to retain a visual image of a shape for the length of time necessary to locate the matching shape
- d) The ability to retain for a period of one day a visual image of six forms denoting specific concepts
- e) The ability to reproduce internal details of a pattern
- f) The ability to reproduce complete patterns
- g) The ability to match letters and words

### 2. Reading Achievement

Reading achievement shall consist of the scores obtained on the following standardized tests:

Gates Primary Word Recognition

Gates Primary Sentence Recognition

Gates Primary Paragraph Reading

Survey of Primary Reading Development

### 3. First Grade Reading

First grade pupils are those enrolled in the beginning year of



the elementary school program which consists of six grades.

#### 4. Pattern Copying

Pattern copying shall refer to the reproduction by the pupil of a given geometric pattern including its outer shape and all internal details.

#### 5. Pattern Completion

Pattern completion shall refer to the reproduction by the pupil of a given pattern. In this exercise the exterior shape in the form of a quadrilateral, triangle or circle shall be provided. The pupil must then copy the pattern contained therein.

### DESIGN OF THE STUDY

#### Population and Sample to be Used

A representative sample was selected from the population of beginners entering the first grade of the Edmonton Public Schools in September, 1962.

#### Procedure

1. Tests designed to measure the visual perceptual abilities of beginners were constructed by the investigator and administered in September, 1962.
2. Tests to measure achievement in reading were administered in June, 1963.
3. The correlation between visual perceptual abilities and reading achievement was determined.



### Analysis of the Data

1. Correlations between the visual discrimination test scores and reading achievement test scores were computed.
2. Correlation coefficients were tested for significance from zero.
3. Differences between correlation coefficients were tested for significance.

### HYPOTHESES

The following hypotheses will be tested:

- I. There is no positive correlation between reading achievement and each of the visual discrimination abilities selected for this study.
- II. There are no significant differences in the correlation between each visual discrimination ability tested and reading ability.
- III. There is no difference in the correlation between reading ability and mental age when compared with the correlations between reading ability and different visual discrimination abilities.

### LIMITATIONS OF THE STUDY

Each test used in this study was designed to measure one specific ability. All possible responses in any one test were limited to the same kind of variation of the stimulus form or symbol. It was thus expected that certain variations of stimulus items might produce a significantly higher correlation with reading achievement. From the results thus obtained it would then be possible to select tests which







appeared useful for further study. Tests selected for this purpose would then be refined and examined for reliability and validity. It was not within the scope of this study to establish reliability and validity for the tests used.

#### Summary

In this chapter the topic of the investigation was classified as a problem in visual discrimination. The problem was related to the theory of perception and to the theory of the reading process. The importance of visual discrimination as acknowledged by other investigators was discussed. The design of the study was outlined.



## CHAPTER II

### A REVIEW OF THE RESEARCH

In this chapter the research findings which have made a contribution to what is known of the relationship between visual discrimination and reading will be reviewed. Research studies selected will pertain to form discrimination and to symbol discrimination as related to progress in learning to read. Form discrimination will be concerned mainly with the process of noting similarities and differences in outline drawings, geometric shapes such as triangles, squares and circles, and geometric shapes enclosing patterns. Symbol discrimination will be concerned with the ability to see similarities and differences in letters and words. No reference will be made to visual deficiencies of an organic nature, the association of sound and symbol, or the association of meaning and symbols. These three topics are considered to be beyond the scope of this review. However, several studies pertaining to the development of form copying ability will be reviewed in order to obtain information applicable to the construction and rating of the pattern copying and pattern completion tests.

### FORM AND SYMBOL DISCRIMINATION ABILITY AS RELATED TO READING ABILITY

A series of investigations was begun by Gates (1926) in an attempt to identify perceptual abilities influencing success in reading. Although



the first investigation yielded low correlations between reading ability and the ability to match geometric shapes containing patterns, Gates was still of the opinion that a certain degree of ability in visual discrimination was essential for success in reading and that it was necessary to learn more about word perception. Subsequent studies attempted to discover whether word perception was an acquired ability or an innate capacity and whether the ability was a general ability or a combination of separate abilities.

Gates and Bond (1936) reported the results of a study of the factors determining success and failure in beginning reading. Pupils in four classrooms were given a series of tests during their first year of school. A median chronological age of 6.2 years, a median mental age of 6.2 and a median I.Q. of 98.6 obtained on the Stanford Binet Intelligence Scale indicate that the subjects used were typical first grade pupils. Included in the battery of tests used by Gates were word matching and form matching exercises. Correlations with reading achievement were not of sufficient magnitude to indicate the pupils who would have difficulty in learning to read.

An early study designed to investigate the nature of the perceptual abilities required in learning to read was reported by Smith (1928). The basic assumption was that ability in word recognition depends upon the development of the ability to make visual discriminations at least to the extent of being able to match word forms. Smith attempted to answer the following question:

Does the child who can match well at the beginning of the term attain a greater success in reading than the one who has difficulty in matching?





First grade teachers gave individual letter matching tests to groups of ten pupils representing average, below average and superior children. Pupils were allowed two minutes to match isolated letters and at the end of this time were scored right or wrong. This testing took place during the first week of school before the pupils had received formal instruction. Two weeks later these same pupils were tested for reading ability on the Detroit Word Recognition Test. A correlation of .87 reported between this test and the earlier word matching test points only to the relationship between word matching and word recognition, the one aspect of the reading process examined. Another criticism of this study is that an extremely short time elapsed between the tests. Results thus obtained may not have agreed with results obtained after a longer period of time.

A further investigation carried out by Gates (1940) provided information on the suitability of certain tests for predicting reading progress during the first year of school. Word matching and letter matching tests administered to 173 beginners from eight schools yielded correlations ranging for .35 to .47 with reading ability measured at the end of the first half year using Gates Sentence Reading and Word Recognition Tests. The reliability of the word matching test used in September was quoted as .82 and that of the letter matching test as .96. Results of this investigation would appear to be of importance to the question of visual discrimination as a factor in learning to read. Although correlation coefficients obtained were too low to have predictive value, a substantial relationship was indicated. Gates admits that one limitation of his study is that reading ability was





measured at the end of the first half year but not at the end of the first year. Findings of this study made a valuable contribution to the knowledge of factors influencing success in learning to read.

In a study conducted by Hill (1936) three types of word discrimination were measured before reading instruction was begun. The first test consisted of words alike only at the beginning, middle or end. The second test consisted of words alike except for single letters, one syllable, or the order of letters. The third test consisted of words having the same configuration. Pupils were directed to mark on their test papers the word displayed on a card. At the end of fourteen weeks, achievement in reading was measured by a word recognition test prepared from the material used for instruction in reading. The correlation between word discrimination ability and reading ability was not found to be significant and thus no relationship was established.

The relationship between reading ability and word and letter matching ability was examined by Petty (1939). A condensed form of the Lee Clark Reading Readiness Test was administered either individually or in small groups to 102 first grade pupils. The test required the pupils to match letters and to match words by crossing out incorrect letters. Correlations between reading achievement and scores in these tests were reported as .44 for the untimed test and .40 for the timed test. This study fails to add new knowledge concerning the relationship between word matching and success in learning to read. Correlations obtained were based on teacher assigned marks which are likely to be a subjective measurement of reading ability.



A brief summary of a study carried out by Steinbach (1940) is given by Gray (1940). The subjects were three hundred first grade pupils in nine schools. From a series of tests administered to these pupils, measures of different abilities were obtained. An analysis of the results indicated that the following variables were "closely related" to reading achievement:

- a) mental age
- b) ability to discriminate between letter forms
- c) ability to discriminate between word forms

There was no indication that the relationship between these variables and reading achievement was sufficiently close to have a predictive value.

Phelan (1940) administered tests to 460 fourth and fifth grade pupils to determine to what extent visual perception was related to variance in reading and spelling. The findings of this study indicated that 7.56 per cent of the variance in reading achievement was attributable to variation in visual perception of words.

Harrington and Durrell (1955) studied the relative influence on reading of mental age and various perceptual factors. They examined the relationship between success in reading and visual discrimination and also the relationship between mental age and success in reading. Visual discrimination was measured by having pupils look at a flash card and then select the word in a multiple choice situation. Intelligence was measured by the Otis Quick Scoring Test. Reading ability was measured by an unspecified oral reading test and a silent reading word classification test. A significant correlation was reported between the visual



discrimination test and the reading tests but the correlation between reading ability and mental age was not significant. Here, again, the significance of the correlations reported precludes an exact interpretation of the results. Reading ability measured with standardized reading tests produces meaningful results in contrast to reading tests constructed for a specific investigation. The silent reading word classification test involves a limited aspect of the reading process.

Two thousand first grade pupils were tested by Durrell and Gavel (1958) for the purpose of determining the factors which affect success in first grade reading. When letter matching ability was measured in September, it was found that 9.6 per cent of the pupils were able to match correctly twenty-two or more capital letters and twenty or more lower case letters. On the basis of these scores, it was concluded that, for most pupils, letter matching exercises were of little value. When correlation coefficients were computed, letter matching ability produced a correlation of  $-.06$  with chronological age,  $.44$  with mental age, and  $.45$  with intelligence. Reading achievement in June was measured by a word recognition test and a paragraph test constructed by the authors. The Detroit Word Recognition Test was also used. The ability to match capital and lower case letters was found to have a correlation of  $.22$  with reading ability. Failure to measure reading ability with a standardized test is a weakness in this study also. The use of the Detroit Word Recognition Test yields valuable information on this one aspect of reading ability but no attempt was made to compare this correlation with that of other abilities such as word matching.





Letter reversals such as p - b, b - d, and W - M were recognized by Krise (1949) as a probable factor affecting reading efficiency at the college level. Krise conducted an experiment using printed material in which reversible symbols were substituted for vowels. College students used as subjects required a greater amount of time to learn reversible symbols as compared to non-reversible symbols. Krise attributed this difference in time to the confusion caused by the reversible characteristics of the symbols substituted for vowels. From the results of this experiment it would appear that a difficulty which persists to an advanced level must present a serious problem to children learning to read.

Perception of symbol orientation and early reading success was investigated by Potter (1949). Several of the findings are reported by Traxler (1955) and also by Townsend (1951). Pupils were tested on their ability to perform the following tasks:

1. match two, three and four letter combinations
2. match representational and geometric shapes
3. copy shapes

From the results of these tests Potter reached the following conclusions:

1. Good perception of words (including an awareness of left to right progression) exists in many children about to begin reading.
2. The ability to avoid reversal errors was found to be a crucial ability for early reading success.
3. The relationship between copying shapes and matching ability remains "rather high" when mental age is controlled.





Perceptual ability as one of the factors determining success in reading was examined as a factor contributing to reading disability by Coleman (1953). His assumption was that visual perception develops in stages and that it is more of a general ability. Coleman refers to the stages of development recognized by the Gestalt psychologists and describes these stages as:

1. perception of the crude whole
2. differentiation of details
3. integration of the differentiated parts into an articulated whole

The purpose of Coleman's study was "to investigate the gross development of visual perception in a group of reading disability cases ranging in age from eight to thirteen years. The test selected to measure perceptual discrimination was the non-verbal section of the Alpha Test of the Otis Quick Scoring Intelligence Test. This section is claimed by Coleman to have face validity in that form discrimination ability is measured. The mental age thus obtained may be stated as the perceptual age of the subject. An individual not retarded in perceptual development would then attain a perceptual age equal to or above his chronological age. It was hypothesized that reading disability cases would be retarded in perceptual development and that they would score on this test below the median for their age group. The thirty-three children as a group were found to be almost a year retarded in perceptual development when compared with their age peer group. The difference in means is significant at the .01 level. The difference in means between



the perceptual development of the group and general intelligence is also significant at the .01 level. However, Coleman adds that six children attained perceptual ages above their chronological ages and for this reason the conclusion reached from this study is that "perceptual development lagged significantly behind the development of general intelligence in a majority of cases." Thus it was not possible from the findings of this study to state that perceptual ability of the type tested by this section of the Otis Test is a pre-requisite for success in reading.

A study conducted by Bond and Clymer (1955) was also designed to investigate visual perceptual ability as one of the factors determining success in reading. The purpose of the study was "to investigate the interrelationships of scores obtained on the Science Research Associates Primary Mental Abilities Test for elementary pupils, two psychological tests devised by the authors, a reading capacity test, and the general reading ability of fourth grade pupils." The statistical analysis used to obtain this relationship was a correlation matrix of all the variables. The sample consisted of eighty-seven subjects from two representative schools of a suburban community. The following tests were administered:

1. Gates Reading Test, Type A to appreciate the general significance of a paragraph, and Type D to note details.

2. A figure and ground test constructed by the authors.

This test required pupils to identify which of five simple straight line figures is contained in a com-



plex geometric drawing. This test was designed to measure the ability necessary to recognize syllables and root words within larger word units.

3. A perseveration test. This test was designed to measure a rapid reaction to a series of stimuli. This test required pupils to write a A b B c C immediately after completing two different series of letters.
4. Primary Mental Abilities Perception Test. Pupils were required to select matching figures in a speed test.
5. Primary Mental Abilities Space Test. This test required pupils to select a geometric form to make a complete square.

Correlations reported in this study are negative or low positive correlations. The findings did not support the existence of a visual perceptual factor contributing to success in reading. In evaluating this study it would appear that Bond and Clymer were correct in their assumption that different results may have been obtained by using a different measure of reading ability. The one reading test selected did not make it possible to obtain correlations with other facets of the reading process.

Goins (1958) carried out a detailed study of the relationship between visual perceptual abilities and success in learning to read. In this study, visual perception was defined as "that process by which





phenomena are apprehended by the mind through the medium of the eye." The purpose of the study was "to ascertain the level of competence in visual perception of first grade children and the correlation of their perceptual abilities with their achievement in reading." Perceptual ability was measured by a set of fourteen tests adapted from a set of unpublished tests constructed by Thurstone. These tests were submitted to a panel of experts to establish content validity. The tests were non-verbal and consisted of the following tasks:

1. finding pictures which are alike
2. completing a picture to make a matching pair
3. matching pictures
4. matching patterns, completing patterns, and copying patterns
5. matching forms involving spatial orientation
6. selecting pairs of objects which do not contain an object in a reversed position
7. selecting pictures to match those shown on a screen (visual memory)
8. recognizing ink blot pictures of familiar objects (closure)

Reading achievement was measured by the Chicago Reading Tests. This standardized test for which parallel forms are available, is considered suitable for measuring reading progress in the early stages. All tests were administered by the investigator to 120 first grade pupils from two schools.





Product moment coefficients of correlation were computed for the group as a whole to increase reliability. The following correlations were reported:

- a) Correlation between the visual tests and reading achievement in December
 

Test of reversals	.479
All other tests >	.338
- b) Correlation between visual tests and reading achievement in May
 

Test of reversals	.491
Copying patterns	.519
- c) Correlation between visual tests and intelligence (obtained from records)
 

Copying patterns	.477
Spatial orientation	.451

From these results Goins concluded that the ability to copy patterns and the ability to detect reversals were the visual skills most closely related to reading ability. A factor analysis of the perceptual tests revealed two main factors but reading was not involved in the first factor. The tests that appeared to be the best measure of the second factor were Pattern Copying and Pattern Completion. Goins is of the opinion that her tests did not measure perceptual abilities in the reading process and for this reason questions the value of form discrimination tests and exercises at the pre-reading stage. This study provides a detailed survey of the relationship between perceptual ability and reading achievement but the findings are limited to pictures and forms. A comparison of the correlations obtained with those obtained between symbol discrimination and reading achievement would have



provided essential information as to the comparative value of various types of discrimination exercises.

Another study attempting to isolate the perceptual factor in reading was that of Malmquist (1958) who gathered data with the following tests:

1. selecting pairs of similar geometric figures
2. selecting matching groups of letter combinations
3. selecting matching combinations of digits
4. selecting matching geometric configurations
5. selecting matching pictures from a larger group

Subjects were 365 first grade pupils from two urban communities in Sweden.

Analysis of the data produced the following correlations:

- a) Correlations between the tests mentioned above ranged from .34 to .47 with the exception of the correlation between tests (2) and (3) which was .73. These tests appear to be testing the same ability since the variance accounted for at least .50.
- b) Correlations between separate tests and reading ability were low.
- c) The correlation between the test battery and reading ability was .31.

Malmquist reports that the reading tests were standardized on a population of 2,400 and that content validity was established. Reliability was obtained by using item analysis and test-retest procedures.



Reliability for the visual perception tests was less satisfactory and is rated low for tests (1) and (5).

Research findings from this study indicate that the ability to distinguish between letters and numbers is more closely related to reading ability at the first grade level than the ability to distinguish between geometric shapes or the ability to discriminate between pictures. Malmquist expresses agreement with Gates' (1926) opinion "that perception is not a unitary function which operates uniformly in all situations involving detailed visual discrimination." Malmquist is of the opinion "that visual perceptual ability is to a great extent specialized and varies with different types of material." Malmquist's study makes a notable contribution in the field of visual perception and reading ability. The study was designed so that it was possible to examine the differences in the correlations between various types of form and symbol discrimination and reading ability. However, the low correlations obtained failed to produce large differences in correlations.

#### FORM COPYING ABILITY AS RELATED TO READING ABILITY

The relationship between form copying ability and reading ability has received less attention on the part of research workers than the relationship between form discrimination ability and reading ability. One reason for this difference may be the nature of the reading process which does not require a motor response of the type involved in copying or writing. An obvious assumption would be that the ability to discriminate between forms and symbols is an integral part of reading





ability whereas the relationship between reading ability and copying ability would be more obscure. Before reviewing the studies which investigated this relationship it will be necessary to consider briefly what evidence is available to indicate the approximate level of form copying ability found among first grade pupils.

Bender (1938) observed that six-year-old children were able to draw a circle, a diamond and parts of rectangles. Children of seven years were able to draw a diamond placed in the centre of a long rectangular shape having pointed ends.

A theory proposed by Townsend (1951) stated that "the copying of a form by a child may be said to involve a combination of form perception, comprehension of form, and motor skill." Townsend tested the following hypotheses:

1. Copying ability will correlate more highly with mental age than with chronological age and more highly with form perception than with motor abilities.
2. Form perception will correlate more highly with mental age than with chronological age and more highly with copying than with motor abilities.
3. Form perception and copying may be expected to show more rapid growth during year six and possibly year seven.

Form perception was measured by requiring pupils to match given shapes. Copying ability was measured by requiring pupils to draw a figure presented to them with the instructions "Draw that!". Drawings





made by 287 pupils between the ages of 6.1 and 9.3 were rated according to a rating scale having a high degree of reliability. Data obtained from these tests produced a correlation of .60 between copying ability and form perception, but when the effect of mental age was controlled the correlation was reduced to .42. However, a weakness caused by eighty perfect scores in the form perception test appeared in the statistical analysis. Townsend concluded from this observation that the ability to discriminate between geometric forms had fully developed in these pupils. This study may have been more effective using subjects of pre-school age rather than pupils of nine years. Stages of development may have been more clearly defined thus providing information on the extent to which perception of form is developed in six-year-old children. Copying ability showed a rapid improvement to year seven and to a mental age of eight.

The purpose of an investigation by Graham, Berman and Ernhart (1960) was to examine changes with age in the ability of pre-school children to copy simple forms. The population used in this study may be said to be more representative than populations used in other studies. Each of the six age groups tested was composed of eighteen white and Negro children. Intelligence quotients ranged from 75 to 173 with a mean of 119.4 and a standard deviation of 23.3.

Pupils were required to copy eighteen line drawings of shapes and forms shown on individual cards. These forms were of increasing difficulty and testing was discontinued after three successive failures. The scoring of these drawings was done by two independent judges who



examined a number of details in each drawing. Full information on the method of scoring is given in the report. Results show a steady increase with age in the percentage of accurate reproductions for each age group. In the opinion of the investigators the major finding was that the reproductions increasingly approach the original in all dimensions. It was also noted that the order of difficulty of the eighteen designs was consistent with the increase in age but what characteristics contributed to the difficulty of the design were not known. From observations only, the investigators suggest that changes in direction in the drawing and also the number of parts appeared to be related to its difficulty.

Piaget and Inhelder (1956), in their study of the child's conception of space used 21 figures to be copied by a group of children ranging in age from one year to seven years. According to the findings of this study, the diamond shape was mastered at five years and six months. Other observations were "that, from the age of seven, many children can draw the figures correctly right away, their construction being anticipated by a mental image drawn up in advance."

A study which involved abilities similar to those necessary for copying forms or patterns was conducted by Hildreth (1932). The development of letter copying abilities was examined during a four year period. Three groups of children of four years, five years, and six years of age were required to copy words and letters and were retested at nine month intervals. Complete mastery of letter construction was attained by the end of the second grade. An observation made in this study was that



pupils who had had no reading instruction obtained scores slightly lower than those in the same age group who had begun reading and writing. Also, when pupils were matched for age, those with a higher mental age obtained slightly higher scores. These results appear to agree with Townsend's findings that copying ability improved steadily to year seven.

Terman and Merrill (1960) in the Stanford-Binet Intelligence Scale, assigned the task of copying a square to year five and copying a diamond to year seven. This placement is an indication that these form copying abilities may be expected of children in this age group. As indicated by research findings form-copying ability is well developed. The question of the relationship between form copying ability and reading ability may now be examined.

Wilson (1938) used as his subjects fifty-four five-year-old kindergarten pupils to study the relationship between letter copying ability and word recognition ability. When mental age was held constant the correlation between these two abilities was found to be .71 but when intelligence was held constant the correlation was .69. Pupils were again tested during the spring term in grade one to determine the correlation between reading achievement and writing words. A correlation of .78 was obtained at this time. The following year in the second grade a correlation of .74 was obtained between these two abilities.

In this connection it may be noted again that Goins (1958) found a correlation of .51 between pattern copying ability in September





and reading achievement in May. An examination of the tests administered to first grade pupils reveals, however, that they were required to complete a pattern but were not required to copy a pattern.

Justison (1963) used four of Bender's (1938) figures as part of a pattern copying test administered to third grade pupils to test the hypothesis that copying ability is positively related to reading ability. An objective rating scale was evolved by using the following criteria:

1. size and proportion
2. component parts or elements
3. configuration
4. orientation
5. precision in the execution of angles, curves, and oblique lines

Two points were allowed for each criterion making a total of ten points for each figure.

Reading achievement was measured by the California Reading Achievement Test. A correlation of .39 was obtained between copying ability and the total vocabulary score. The correlation between copying ability and the score for comprehension was found to be .418. On the basis of these findings Justison concluded that a positive relationship exists between copying ability and reading ability.

A different procedure was adopted in a study reported by Glennon (1961). Tests used to measure copying ability were speeded in contrast to the untimed tests used by other investigators. In the first test, fifty-three third grade pupils were required to copy a printed text and



in the second test to copy a set of designs borrowed from tests used by Benton, Gates, and other authors. Gates Reading Survey was used to measure reading achievement. A correlation of .31 was obtained between reading ability and form copying ability. The correlation between text copying ability and reading ability was .46. It may be noted here that the higher correlation with reading ability is found in the case of copying ability having to do with the printed text.

Justison (1963) and Glennon (1961) have established a definite correlation between copying ability and reading ability at the third grade level, but their studies make no contribution to what is known of the correlation between copying ability at the pre-reading stage and reading achievement at the first grade level. Substantial relationships were obtained ranging in magnitude from .31 to .74 by Wilson (1938), Goins (1958), Glennon (1961) and Justison (1963). Goins (1958), who examined in detail a number of visual perceptual abilities, found that pattern copying ability produced the highest correlation with reading ability.

Gates (1926) pointed out the need for more information concerning the types of word perception abilities. Gates (1922) had already concluded that there was no general power of visual perception. Several investigators are in agreement with Gates (1922). Phelan (1940, p.7), stated that:

Visual perception is an important factor in learning to read but the nature of the ability described as visual perception and the relative influence it exerts on reading achievement are variously described.



Phelan (1940, p. 7) subscribes to Gates' (1922) theory that the ability to detect small differences between words is associated with successful reading achievement but that the ability to perceive words is relatively independent of the ability to perceive digits or geometric forms.

Malmquist (1958, p. 276) states that his conclusions confirm to some extent the views expressed by Gates that perception is not a unitary function or a capacity which operates uniformly for all kinds of data. He adds that he is inclined to assume that visual perceptual ability is to a great extent specialized and varies with different types of material.

Goins (1958, p. 99) expresses agreement with Thurstone's theory that several primary mental abilities exist and that one of these abilities is a perceptual factor. Coleman (1953) was also of the opinion that visual perception is more of a general ability and is supported in this theory by Townsend (1951) and Steinbach (1940).

The research reviewed in this chapter indicates that a positive relationship exists between reading ability and the ability to discriminate between forms and symbols. Low correlations obtained in well-designed studies reveal the presence of other factors in the mastery of reading material. These factors are generally held to be word configuration clues, meaning and context clues, and word analysis. This study examined only the ability to see similarities in forms and symbols as related to reading achievement and is not concerned with the meaning of printed symbols. This visual discrimination phase of word perception is recognized by Russell (1961, p. 105) who cites a number





of studies of word perception that suggest how word recognition takes place in reading. From these studies Russell states that the first step seems to be observation of the whole word or phrase in terms of general shape or configuration. The arrangement of the consonants determines the general shape and serves as a primary perception clue. Also on the basis of this group of studies Russell lists as a clue the length of the word and clues at the beginning, end and in the middle of the word with those at the beginning of greatest importance. These clues form a group which appears to depend upon visual discrimination ability. A second group of clues consists of meaning and context clues together with word analysis clues which demand visual scrutiny of the word. Research studies included in this chapter have centred around the visual discrimination aspect of word perception.

Discrimination learning has been investigated in great detail by research workers in the field of psychology but these findings have not been related to the kind of visual discrimination necessary for printed materials. Vernon (1952, p. 37) has related word recognition to the identification stage of perception. The literature concerning perception reveals one other theory of visual discrimination related to word perception in reading. This theory is proposed by Dember (1960, p. 59) who sees four levels of difficulty in perceptual processes as follows:

1. Detection

The individual is required merely to indicate when a pre-defined stimulus event has occurred. The task is represented





by the question, "Do you see the two boxes?".

## 2. Discrimination

The individual is required to see the difference between two separate stimuli. The task is represented by the question, "Do these two boxes seem different?".

## 3. Recognition

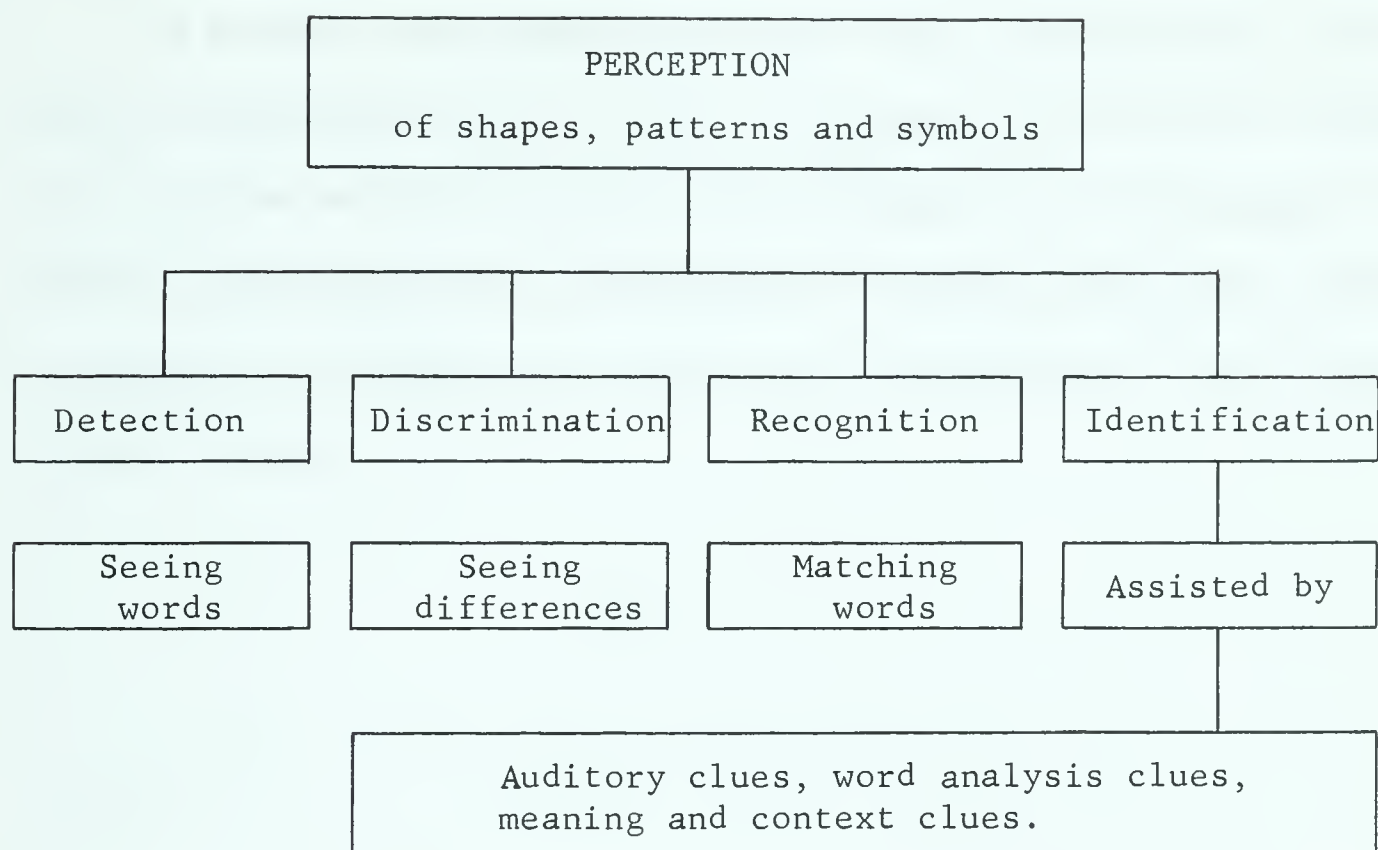
The individual is required to match a stimulus with one of a set of specified alternatives. The task is represented by the question, "Which of four boxes is the same as this box?".

## 4. Identification

The individual is required to identify the stimulus. The task is represented by the question, "What word is this?".

Dember further notes that detection and discrimination both involve response to a change of stimulus and that this responsiveness to change is a fundamental feature of perception. Similarly the response may be made to constancy or equality. It may be assumed that a subject who makes a consistent response in the presence of one stimulus and a different response in the presence of another stimulus shows evidence whereby a difference in perception can be inferred. Using the levels of difficulty in perceptual processes as proposed by Dember, the place of visual discrimination in the psychology of perception and in the psychology of reading may be illustrated by the following diagram.





This representation relates a stage in word perception to one of the levels of perceptual processes. In the final identification or recognition of a word, provision is made for the place of additional word clues which may also be used.

### Summary

Various kinds of visual discrimination pertaining to the reading process have been shown to have a positive correlation with reading ability. Investigations have involved form matching, word and letter matching, and pattern copying. While the correlations had been compared in different studies, there was no evidence to indicate that pattern copying ability had been compared with word and letter matching ability, nor was there evidence that rotations and reversals of forms and symbols



had been included.

A further investigation of these visual discrimination abilities will be undertaken in this study. An attempt will be made to isolate some of these abilities by using tests designed for this purpose. The relationship between these abilities and reading achievement will then be studied and compared with abilities corresponding to those reported in this chapter.





## CHAPTER III

### THE EXPERIMENTAL DESIGN

In this chapter a description of the sample, the testing instruments, and the testing procedures will be given. The analysis of the data will be discussed.

### THE SAMPLE

Three urban schools were selected for the study. Each school represented one of three socio-economic areas. The socio-economic status of each school was determined according to the classification adopted by the Edmonton Public School Board.

School A represents a middle socio-economic area. All the grade one pupils attending this school in September, 1962 were used as subjects in the study. School B represents a low socio-economic area. One class of grade one pupils was used in this school. School C represents a high socio-economic area. Again, one class of grade one pupils was used. The total number of pupils tested in September was 134. During the school year nineteen pupils transferred out of these classes to other schools leaving a total of 115 pupils in June. Of this number thirteen pupils were absent for one or more tests. The net total for whom complete test scores were available at the conclusion of the June testing period was 102 pupils. Table 1 is a summary of the changes in the school populations during the time that elapsed between



the two testing periods.

TABLE 1  
SUMMARY OF TRANSFERS AND ABSENCES

	Pupils Tested in Sept.	Pupils Absent in Sept.	Transfers Out	Pupils absent in June	Pupils included in study
School A	70	11	1	5	53
School B	32	6	1	0	25
School C	32	2	0	6	24
Totals	134	19	2	11	102*

\* Number of pupils completing all tests.

The Detroit Beginning First Grade Intelligence Test (1935) was administered by the classroom teachers during the week preceding the administration of the Visual Discrimination Tests. Table 2 is a summary of the results obtained on the Detroit Intelligence Tests. According to information available from the Elementary Education Department of the school system, the mean intelligence quotient for all beginners was 116. Table 2 indicates that the mean intelligence quotient for the group was 116.47. Thus it may be concluded that the pupils used in the sample were typical beginners from the school population of the city.



TABLE 2

## SUMMARY OF INTELLIGENCE TESTING IN SEPTEMBER

Detroit Beginning First Grade Test	Mean	Standard Deviation
Chronological Age (in months)	74.13	4.24
Mental Age (in months)	86.36	9.0
Intelligence Quotient	116.47	13.5

## DESCRIPTION OF THE TESTS

For the purpose of investigating in greater detail the relationship between the ability to detect rotations and reversals, to copy geometric patterns and to match letters and words it was necessary to construct a set of tests. Similar test items were found in standardized tests but the number of examples in any one category did not permit a detailed study of the various types of reversals, rotations or pattern copying. For this reason sub-tests consisting of a number of items in one category of reversals or rotations were designed by the investigator.

One set of six sub-tests consisted of items requiring the pupil to match or copy forms only. This set was designed to isolate, if possible, difficulties with rotations, reversals, or copying that might exist apart from the confusion experienced by many pupils in the recognition of words and letters. It was also expected that tests constructed of forms only would eliminate the effect of pre-school experiences with printed materials. Letter and word matching tests were



included for the purpose of comparing this ability with form discrimination ability.

Copies of the tests constructed by the investigator may be found in the Appendix. A description of the purpose of each test and of its construction follows.

#### A. Visual Discrimination Tests

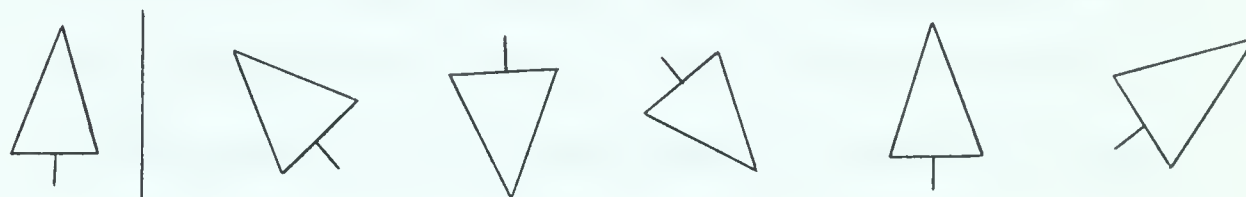
##### 1. Form Discrimination

###### Test 1.

###### a) Purpose

The purpose of this test was to determine the extent to which the rotation of a form creates a problem in recognition.

###### b) Construction



The pupil was required to look at the stimulus item on the left and to mark the matching item. Distractors were rotated forms.

###### c) Scoring

One point for each correct response was given.

###### Test 2.

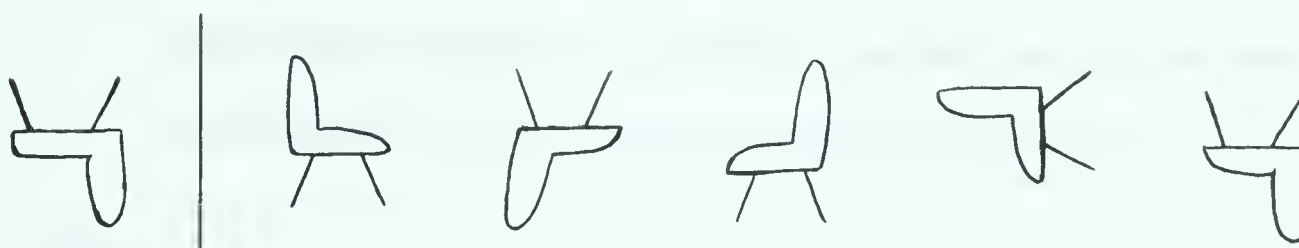
###### a) Purpose

The purpose of this test was to determine the extent to which the rotation and reversal of a form creates a problem in recognition.





## b) Construction



The pupil was required to look at the stimulus item on the left and to mark the matching item. Distractors included rotated and reversed forms.

## c) Scoring

One point for each correct response was given.

## Test 3.

## a) Purpose

The purpose of this test was to investigate the pupil's ability at the pre-reading stage to distinguish between word configuration shapes. This test was designed to investigate also the relationship of immediate visual memory and reading ability.

## b) Construction

The forms used in this test were actual word configuration shapes.



Immediate visual memory was tested by requiring the pupil to mark in his booklet the form matching that displayed on a large card.



## c) Scoring

The first item was a practice item and was not scored.

One point for each correct response was given.

## Test 4.

## a) Purpose

The purpose of this test was to determine the degree of accuracy in the child's perception of pattern details.

It was expected that the manner in which a child reproduced a pattern might provide clues as to the manner in which he perceived details.

## b) Construction

Tasks used as models are found as follows:

(1) Detroit Beginning First Grade Intelligence Test (1935)

(2) Bender Visual Gestalt (1938)

(3) Stanford Binet Intelligence Scale (1960 Revision)

The pattern to be copied was printed on the left side of the test pages. Pupils were instructed to reproduce the pattern in the blank space at the right side of the page.

## c) Scoring

The first set of criteria included placement on the page, size, external shape, internal details of the pattern, distortion of size within the pattern, rotation, reversals, and motor control. Pattern reversal was eliminated



from the second set of criteria when it was noted that this characteristic was not apparent in the drawings. A sample set of tests scored by two independent raters revealed that many differences still existed in the interpretation of the revised directions. In order to relate the degree of accuracy in perception to the criteria for scoring, motor control was eliminated as one of the criteria in the final revision of the rating scale. It was noted that intense concentration on the part of the pupil while attending to the details of the pattern tended to focus less attention on the straight quality of the line while at the same time the line may correctly join two designated points. An examination of the beginners' pencils used in school indicated that some difficulty would be experienced by pupils in being able to see whether the pencil had touched a line in forming an intersection. For the more difficult patterns marks were allotted to certain refinements in pattern reproduction. It was then possible for pupils capable of executing straight lines, accurate intersections and good angles to receive credit for this ability.

The rating scale for pattern copying was constructed in accordance with similar scales in commercial tests. The Stanford-Binet Intelligence Scale (1960) includes a rating scale for copying a square at Year V - 5, and for copying a diamond at Year VIII - 3. Bender (1938) found six-year-





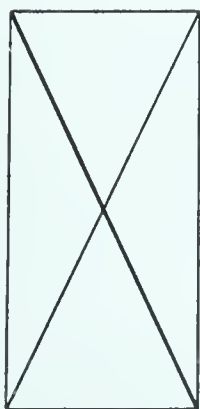
old children to be capable of copying a circle, diamond, part of a rectangle and a dotted pattern. Seven-year-old children were able to copy a diamond enclosed by a hexagonal figure. Piaget and Inhelder (1956) found that a diamond was copied at five years and six months.

Graham, Berman and Ernhardt (1960) discredited angles which were rounded or dog-eared. In the final revision the criteria adopted for the present study for rating each pattern in Test 4 were size, exterior details, and internal details. Complete directions may be found in the Appendix.

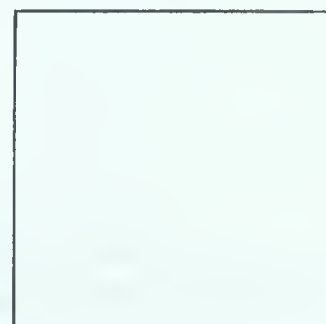
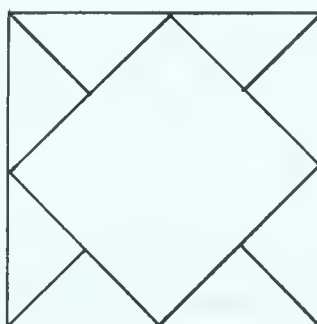
#### Test 5.

##### a) Purpose

The purpose of this test was to determine the degree of accuracy in the child's perception of the details of a pattern when not required to copy the outline of the drawing before adding the pattern detail.



Example of Pattern Copying in Test 4. Pupils were instructed to draw the pattern in a blank space at the right.



Example of Pattern Completion in Test 5. Pupils were instructed to complete the right hand drawing.



## b) Construction

The model used for Test 5 was the pattern completion sub-test of the Detroit Beginning First Grade Intelligence Test (1935). Four bead patterns were also included. Pupils were instructed to draw the missing beads.

## c) Scoring

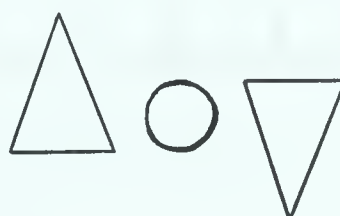
The scoring directions for the pattern completion sub-test of the Detroit Test were used as a basis in formulating a rating scale. Requirements for angles in Test 4 were also applied to Test 5. The details of the rating scale for each figure may be found in the Appendix.

## Test 6.

## a) Purpose

The purpose of this test was to examine the part played by delayed visual memory in beginning reading when visual memory is not associated with printed symbols.

## b) Construction



Example of set of forms used in Test 6.  
This set of forms was designated as "monkey".

A series of six sets of forms representing names of animals was presented to the pupils on the first day. Delayed visual memory was tested by having pupils match



sets of forms with pictures of animals on the second day.

c) Scoring

One point was given for each correct response.

2. Symbol Discrimination

The second set of tests consisted of the usual exercises in letter and word matching. One special feature of these tests was that they were designed to examine specific matching abilities. In each test the pupil was required to mark the letter or word identical to the stimulus item at the left.

Test 1.

a) Purpose

The purpose of this test was to determine the child's ability to perform a simple letter matching task.

b) Construction

No reversals or rotations were included but letters similar in some respects as in the following example.

b		h	m	n	p	r	b
---	--	---	---	---	---	---	---

c) Scoring

One mark was given for each correct response.

Test 2.

a) Purpose

The purpose of this test was to examine the child's ability to perform a more complicated letter matching task.



## b) Construction

Rotations and reversals were included as in the following example.

M	W	N	X	V	M	A
---	---	---	---	---	---	---

## c) Scoring

One mark was given for each correct response.

## Test 3.

## a) Purpose

The purpose of this test was to examine the pupil's ability to see differences in words having similar configurations.

## b) Construction

Nonsense words of similar configuration were used as in the following example.

break	kreak	break	draek
-------	-------	-------	-------

## c) Scoring

One mark was given for each correct response.

## Test 4.

## a) Purpose

The purpose of this test was to examine the pupil's ability to note differences in initial consonants.





## b) Construction

Words selected differed only in the initial consonant as in the following example.

hill	pill	will	hill	till
------	------	------	------	------

## c) Scoring

One mark was given for each correct response.

## Test 5.

## a) Purpose

The purpose of this test was to examine the pupil's ability to note differences in medial vowels.

## b) Construction

Words differed only in the medial vowel as in the following example.

cut	cat	cut	cet	cot
-----	-----	-----	-----	-----

## c) Scoring

One mark was given for each correct response.

## Test 6.

## a) Purpose

The purpose of this test was to examine the pupil's ability to note right to left progressions of the letters in a given word and to note reversals of individual letters in a given word.



## b) Construction

Words used contained reversals in the order of letters and in individual letters as in the following example.

ban	ban	nab	dan
-----	-----	-----	-----

## c) Scoring

One mark was given for each correct response.

## B. Reading Achievement Tests

1. Gates Primary Reading Tests (1958) were selected as one measure of reading achievement. Three types were administered:

(1) Type PWR. Word Recognition - Form 3

This test consists of forty-eight exercises, each of which contains four printed words and a picture which illustrates the meaning of one of them. The task is to encircle the word that tells the most about the picture. The test measures the degree to which a pupil can identify representative words.

(2) Type PSR. Sentence Reading - Form 3

This test consists of fifteen exercises each containing six pictures and three sentences. The pupil marks the three sentences to indicate which picture corresponds to the sentence. The test measures the pupil's ability to utilize context, picture and other clues.



(3) Type PPR. Paragraph Reading - Form 3

This test consists of twenty-six paragraphs, each accompanied by illustrations which are to be marked in such a way as to indicate the meaning of the paragraph. This test measures the pupil's ability to read representative paragraphs with understanding.

2. The Survey of Primary Reading Development (SPRD) (1957)

Form A-1 was selected as a second measure of reading achievement. This is a standardized test presenting activities ranging from the beginning level of reading development to that of comprehending written material above the primary grade level. One special feature in the construction of the tests in this reading survey is the absence of picture clues in the measurement of reading ability. A second unique feature is the inclusion of a form comparison test which measures the pupil's form discrimination ability at the end of the first grade. There are six tests in this survey.

Test 1 - Form Comparison

This test samples the child's ability to see likenesses and differences between pairs of geometric forms.

Test 2 - Word Form Comparison

This test samples the child's ability to see likenesses and differences between pairs of words. There is no attempt to measure word recognition or word meaning.





### Test 3 - Word Recognition

This test measures the pupil's ability to recognize a word pronounced by the test-administrator. It also measures the pupil's sight vocabulary by using auditory clues as compared to the Gates Word Recognition Test which utilizes picture clues.

### Test 4 - Sentence Recognition

This is a second test using auditory clues and is comparable to the Gates Sentence Reading Test which utilizes picture clues. The pupil marks the sentence read by the test-administrator.

### Test 5 - Sentence Comprehension

This test measures the pupil's ability to understand the meaning of a sentence and to select the word or words that will complete the statement.

### Test 6 - Story Comprehension

On each page is a story which the child reads to himself. From the statements which follow the story he is to select those which are correct in terms of the story content. In the first stories the statements refer to specific content. Later stories offer more complex problems in comprehension.



## TESTING PROCEDURES

## 1. Visual Discrimination Tests

The Visual Discrimination Tests were administered by the investigator to all classes during the third week of September (1962). On the first day the form discrimination tests were given but Test 6 involving delayed visual memory was not completed until the second day. The letter and word matching tests were given on the second day.

Tests were scored by the investigator. To eliminate scoring errors due to differences in the interpretation of the rating scale for pattern copying and pattern completion a sample group of tests was scored by two independent markers. Directions for scoring were then reviewed in areas where more than one interpretation was possible. Agreement between the two markers and the investigator was obtained after the third revision.

The reliability between raters was determined by computing the Kendall Coefficient of Concordance as follows:

Coefficient for Pattern Copying Test Inter-Rater

Reliability = .69

Significant at the .05 level of confidence.

Coefficient for Pattern Completion Test Inter-Rater

Reliability = .89

Significant at the .02 level of confidence.



## 2. Intelligence Tests

The Detroit Beginning First Grade Intelligence Test, Form A, was administered to all classes during the second week of September, 1962. Pupils were tested in small groups in order to provide adequate supervision and direction. These tests were administered by the classroom teachers who are capable teachers having had several years' experience with this test. In the case of one teacher who had had no previous testing experience, the testing was done by the investigator. Tests were scored by classroom teachers.

## 3. Reading Achievement Tests

Reading achievement tests administered by the investigator during the first and second weeks of June (1963), were:

Gates Primary Word Recognition Test

Gates Primary Sentence Recognition Test

Gates Primary Paragraph Reading Test

Survey of Primary Reading Development

All tests were scored by the investigator.

## ANALYSIS OF DATA

The raw scores obtained from the tests were given the following statistical analysis:

- (1) Correlation coefficients between each of the visual discrimination tests and each of the reading tests were computed.



- (2) Mean scores and standard deviations were computed.
- (3) Tests of significance were applied to the correlation coefficients. The significance of the correlation coefficients from zero was obtained from Ferguson (1959) Table F. The significant differences existing in correlation coefficients were determined by calculating the "t" scores. The level of significance of these scores was obtained from Ferguson (1959) Table B.

#### Summary

A description of the subjects used in this study was given in this chapter. The details of the construction and scoring of the visual discrimination tests were explained. An outline of the statistical treatment of the data concluded the chapter.





## CHAPTER IV

### ANALYSIS OF DATA AND INTERPRETATION

The purpose of this chapter is to examine the following results of the testing program:

- I. Performance on the Visual Discrimination Tests
- II. Performance on the Reading Tests
- III. The Relationship Existing Between the Visual Discrimination Tests and Reading Achievement
- IV. The Relationship Existing Between Mental Age and Reading Achievement

#### I. Performance on the Visual Discrimination Tests

Scores on the first section of the Visual Discrimination Tests disclosed the ability of the pupils to discriminate between forms. Table 3 shows the mean score, standard deviation, and variance on each of the form discrimination tests.

Table 3 reveals a number of facts concerning the level of difficulty of the form discrimination tests. The low standard deviations indicate that the grade one pupils performed at a uniform level in the tests involving rotated forms, reversed forms, word configuration forms and in delayed visual memory for forms. With a possible score of 8 and a mean score of 7.39, it is evident that the rotation of forms presented little difficulty in this type of form matching. A lower mean score of



6.57 out of a possible score of 8 for form reversals suggests that the presence of reversed forms added to the difficulty of this matching task.

TABLE 3  
MEAN SCORES FOR FORM DISCRIMINATION TESTS

Tests of Form Discrimination	Possible Score	Mean	Standard Deviation	Variance
Form Rotation	8	7.39	1.11	1.25
Form Reversals	8	6.57	1.70	2.91
Word Configuration Forms	8	6.31	1.21	1.46
Pattern Copying	88	48.60	10.4	109.98
Pattern Completion	50	26.21	7.57	57.37
Delayed Visual Memory	6	4.33	1.72	2.97
Form Discrimination Total Score	168	99.34	18.47	340.53

The apparent increase in difficulty in matching word configuration forms as indicated by a slightly lower mean score may be related to the element of immediate visual memory present in this test. Visual memory was a crucial factor as pupils were required to remember the correct form during the length of time necessary to look at the stimulus card exposed at the front of the class and to find the matching form in the test booklet. Similarly, in Table 3, a mean score of 4.33 out of a possible score of 6 for the delayed visual memory test may indicate that the effect of a time lapse of one day had an adverse effect on the ability to remember forms.

Again, in Table 3, the mean score of 48.60 out of a possible



score of 88 in the pattern copying test indicates that pupils experienced some difficulty in producing patterns to meet the requirements set forth in the rating scale. As shown in Table 3 a similar situation exists in the Pattern Completion Test where a mean score of 26.21 was obtained out of a possible score of 50.

### Summary

The information presented in Table 3 shows that form matching was not a difficult task for pupils entering the first grade but that pattern copying and pattern completion as rated on these tests demanded a performance at a higher level.

TABLE 4

#### MEAN SCORES FOR SYMBOL DISCRIMINATION TESTS

Tests of Symbol Discrimination	Possible Score	Mean	Standard Deviation	Variance
Letter Matching	12	11.50	.99	.98
Letter Reversals	12	11.06	.99	.99
Word Configurations	10	8.46	1.03	1.06
Initial Consonants	10	7.92	1.80	3.24
Medial Vowels	10	7.57	2.06	4.24
Word Reversals	10	7.16	2.16	4.69
Symbol Discrimination Total Score	64	53.74	5.99	35.95

Table 4 shows the mean scores, standard deviation and variance for the symbol discrimination tests. From this table it is apparent that the first three tests presented no difficulty for these pupils. No problems were encountered when test items included letter reversals





or words with similar configurations.

The three remaining tests involved a more complex type of discrimination with the introduction of differences in initial consonants, medial vowels and word reversals. A slight decrease in mean scores may be noted in these tests. In the letter matching test the mean level of performance is 96 per cent correct as compared to 71 per cent correct for matching words when reversed forms of the word were used as distractors.

#### Summary

The mean scores of the symbol discrimination tests thus indicate that letter matching is a very simple task for beginners but that word matching becomes a more difficult task as the differences become more intricate.

TABLE 5

#### MEAN SCORES FOR READING ACHIEVEMENT TESTS

Reading Achievement Tests	Possible Score	Mean	Standard Deviation	Variance
Gates PWR Test	48	35.29	8.81	77.71
Gates PSR Test	45	27.77	8.84	78.25
Gates PPR Test	26	17.04	4.32	18.74
Form Comparison	12	10.74	1.82	3.32
Word Form Comparison	14	13.74	.72	.52
Word Recognition (Auditory Clues)	17	15.84	1.46	2.15
Sentence Recognition (Auditory Clues)	8	7.65	.55	.30
Sentence Comprehension	9	7.22	1.57	2.47
Story Comprehension	28	12.79	5.85	34.75



## II. Performance on the Reading Tests

The mean scores for the reading achievement tests appear in Table 5. The first three tests, Gates Primary Word Recognition, Sentence Reading and Paragraph Reading (1958) utilize pictures as the stimulus for the correct response. The remaining tests listed in Table 5 are sub-tests of the Survey of Primary Reading Development (1957). Pictures are not utilized in these tests but word and sentence recognition abilities are measured by responses given to an auditory stimulus. Another major difference between the two series of tests is that the Gates tests are timed whereas the Survey of Primary Reading Development is untimed.

Mean scores obtained on the three Gates tests indicate a typical level of performance. The remaining tests, which measure a more diversified range of reading skill, reveal further details as to the nature of certain abilities related to the reading process. The mean score of 10.74 out of a possible score of 12 for form comparison indicates that some pupils at the end of the first grade are still unable to see differences in pattern details. It must also be noted in Table 5 that this difficulty with details is not encountered to a similar extent in the recognition of similarities and differences in words, where a mean score of 13.74 out of a possible score of 14 was obtained. One possible explanation of this lack of difficulty may be the emphasis placed upon word recognition techniques in the grade one program.

The mean score of 15.84 out of a possible score of 17 for word recognition using auditory clues indicates a good mastery of word



recognition techniques. The performance on this test exhibits a high level of achievement similar to that on the Gates Word Recognition Test which utilizes picture clues. It would appear that locating a word pronounced by the teacher offers no complications. It may be pointed out too, that this test includes words not suitable for inclusion in a test using only picture clues.

The same procedure was used in the sentence recognition test. Pupils were required to find a sentence pronounced by the teacher. As shown in Table 5, a mean score of 7.65 out of a possible score of 8 suggests no difficulty here.

Sentence comprehension with a mean score of 7.22 out of a possible score of 9 would indicate a slightly more difficult task but well within the ability of the group. The story comprehension test forced the pupils to rely upon their ability to read and to interpret the stories. As shown in Table 5 a mean score of 12.79 out of a possible score of 28 reflects no unusual aspects in the performance of the group.

### Summary

Mean scores obtained on the Gates Reading Tests reveal no abnormal performance in word recognition, sentence reading or paragraph reading. Several of the SPRD (Survey of Primary Reading Development) sub-tests measured reading ability commonly associated with the early stages of learning to read. Generally speaking, the first grade pupils had progressed well beyond the level of ability necessary in the first four tests comprising form comparison, word comparison, word recognition and sentence recognition.





## RELATIONSHIP BETWEEN VISUAL DISCRIMINATION ABILITIES AND READING ABILITY

To show the relationship between each of the visual discrimination tests and the various measures of reading ability, correlation coefficients were obtained. These correlations are shown in Tables 6 and 7. Two of the tests of reading ability are not included in the group of reading tests for the reason that the form and word discrimination tasks require no actual reading. There remains a total of ninety-eight correlations between the visual discrimination tests and the reading tests. Of this number, thirty-nine are significant at the one per cent level of confidence while an additional group of thirteen correlations are significant at the five per cent level of confidence.

### Form Discrimination Ability and Reading Ability

An examination of Table 6 reveals that the sub-test containing form reversals is most closely associated with reading ability having produced significant correlations ranging from .23 to .36. A less consistent relationship with reading ability was obtained for Form Rotation, Pattern Copying and Pattern Completion. Word form configurations produced a very low relationship while the test of delayed visual memory shows a negligible correlation.

### Symbol Discrimination Ability and Reading Ability

In Table 7 the most consistent relationship with reading is shown by Word Reversals, where coefficients ranging from .27 to .45





TABLE 6

CORRELATIONS BETWEEN FORM DISCRIMINATION TESTS  
AND READING ACHIEVEMENT

Form Discrimination Tests	PWR	PSR	PPR	Form Comparison	Word Comparison	Word Recognition Auditory	Sent. Recognition Auditory	Sentence Comprehension	Story Comprehension
Form Rotation	.25	.19	.15	.27	.002	.14	.07**	.25	.18
Form Reversals	.36	.29	(.29)	.27	.11	.23	(.29)	(.34)	.12
Word Config. Forms	.14	.08	.14*	.33	.11	.15	.13	.21	.11
Pattern Copying	.13	.13	.23	(.36)	.03	.16	.01**	.27	.23
Pattern Completion	.16	.17	.28	.28	.06	.16	.03*	.27	.18
Del. Vis. Memory	.13	.06	.12	.14*	.13	.09	-.15	.04*	.03
Total Form Dis.	.19	.16	.27	.42	.10	.17	.03	.25	.15

(a) Critical values of correlation coefficient:

Significant at .05 level = .17

Significant at .01 level = .23

(b) Significant differences between correlation coefficients:

Brackets ( ) indicate the coefficient which is significantly greater at the .05 level than coefficients marked \* in the same column and significantly greater at the .01 level than coefficients marked \*\* in the same column.



TABLE 7

CORRELATIONS BETWEEN SYMBOL DISCRIMINATION TESTS  
AND READING ACHIEVEMENT

Symbol Discrimination Tests	PWR	PSR	PPR	Form Comparison	Word Comparison	Word Recognition Auditory	Sentence Recognition Auditory	Sentence Comprehension	Story Comprehension
Letter Matching	.08**	.06*	.02**	-.07	-.09	.23	.08	.09*	.12
Letter Reversals	.32	.24	.38	.23	.13	.18	.11	.28	.16
Word Configuration	.09*	.16	.13**	.17	-.02	.03*	.15	.13**	.13
Initial Consonants	.32	.26	.26	.17	.06	.24	.07	.24*	.19
Medial Vowels	.23	.20	.22	.12	.00	.18	.04	.17**	.26
Word Reversals	(.38)	(.32)	(.39)	.27	.05	(.27)	.13	(.45)	.27
Total Symbol Dis.	.40	.34	.39	.28	.03	.31	.14	.38	.31

(a) Critical values of correlation coefficient:

Significant at .05 level = .17

Significant at .01 level = .23

(b) Significant differences between correlation coefficients:

Brackets ( ) indicate the coefficient which is significantly greater at the .05 level than coefficients marked \* in the same column and significantly greater at the .01 level than coefficients marked \*\* in the same column.



were obtained. Low correlations with reading ability are shown in the case of letter reversals, medial vowels and initial consonants. Negligible correlations were obtained for word configuration matching and simple letter matching.

#### Summary

1. A positive correlation exists between visual discrimination abilities tested and measures of reading ability.
2. Tests involving reversals in both forms and symbols produced the highest correlation with reading ability.
3. Several tests, including simple letter matching, show a negligible correlation with reading ability.

#### COMPARISON OF CORRELATIONS BETWEEN VISUAL DISCRIMINATION ABILITY AND READING ABILITY

A number of differences were observed in the various correlations between visual discrimination ability and reading ability. It was necessary to determine which of these differences were significant. A critical value for the "t" score was obtained from Ferguson (1959), Table A. Differences between correlation coefficients found to be significant are reported in Table 8. From this table the following significant differences may be noted:

1. The correlation between word recognition with picture clues and the ability to perceive word reversals ( $r = .38$ ) is significantly greater than the correlation between word





recognition and the following:

- a) Pattern completion ( $r = .16$ )
- b) Matching word configuration forms ( $r = .14$ )
- c) Pattern copying ( $r = .13$ )
- d) Letter matching ( $r = .08$ )
- e) Matching words with similar configurations ( $r = .09$ )

2. The correlation between sentence recognition with picture clues and the ability to perceive reversals in words ( $r = .32$ ) is significantly greater than the correlation between sentence recognition and the following:

- a) Letter matching ( $r = .06$ )
- b) Matching word configuration forms ( $r = .08$ )

3. The correlation between sentence reading with picture clues and the ability to perceive reversals in words ( $r = .39$ ) is significantly greater than the correlation between sentence reading and the following:

- a) Matching words with similar configurations ( $r = .13$ )
- b) Matching rotated forms ( $r = .15$ )
- c) Letter matching ( $r = .02$ )
- d) Matching word configuration forms ( $r = .14$ )

4. The correlation between sentence reading with auditory clues and the ability to perceive reversals in words ( $r = .29$ ) is significantly greater than the correlation between sentence reading and the following:

- a) Letter matching ( $r = .08$ )



TABLE 8  
SIGNIFICANT DIFFERENCES BETWEEN  
CORRELATION COEFFICIENTS

Criterion = Gates Primary Word Recognition (Picture clues)				
		Observed Difference	t	Significance
Correlation with Word Reversals	.38			
Correlation with Pattern Completion	.16	.22	2.20	.05
Correlation with Word Config. Forms	.14	.24	2.33	.05
Correlation with Pattern Copying	.13	.25	2.25	.05
Correlation with Letter Matching	.08	.30	2.39	.01
Correlation with Words Sim. Config.	.09	.29	1.73	.05
Criterion = Gates Primary Sentence Reading (Picture clues)				
		Observed Difference	t	Significance
Correlation with Word Reversals	.32			
Correlation with Letter Matching	.06	.26	2.02	.05
Correlation with Word Config. Forms	.08	.24	2.27	.05
Correlation with Form Reversals	.29			
Correlation with Word Config. Forms	.08	.21	1.88	.05
Criterion = Gates Primary Paragraph Reading (Picture clues)				
		Observed Difference	t	Significance
Correlation with Word Reversals	.39			
Correlation with Words Sim. Config.	.13	.26	2.37	.01
Correlation with Form Rotation	.15	.24	2.16	.05
Correlation with Letter Matching	.02	.37	2.97	.01
Correlation with Word Config. Forms	.14	.25	3.24	.01



TABLE 8 (continued)

Criterion = Sentence Recognition (Auditory clues)				
		Observed		
		Difference	t	Significance
Correlation with Form Reversals	.29			
Correlation with Letter Matching	.08	.21	2.11	.05
Correlation with Medial Vowels	.04	.25	2.15	.05
Correlation with Init. Consonants	.07	.22	1.82	.05
Correlation with Patt. Completion	.03	.26	1.80	.05
Correlation with Patt. Copying	.01	.28	2.74	.01
Correlation with Form Rotation	.07	.22	2.78	.01
Criterion = Sentence Comprehension				
		Observed		
		Difference	t	Significance
Correlation with Word Reversals	.45			
Correlation with Init. Consonants	.24	.21	2.14	.05
Correlation with Words Sim. Config.	.13	.32	3.01	.01
Correlation with Medial Vowels	.17	.28	2.70	.01
Correlation with Letter Matching	.09	.36	2.36	.05
Correlation with Del. Vis. Memory	.04	.30	2.30	.05
Criterion = Word Recognition (Auditory clues)				
		Observed		
		Difference	t	Significance
Correlation with Word Reversals	.27			
Correlation with Words Sim. Config.	.03	.24	2.10	.05





TABLE 8 (continued)

Criterion = Form Comparison at End of First Grade				
		Observed Difference	t	Significance
Correlation with Patt. Copying	.36			
Correlation with Letter Matching	.07	.29	2.44	.01
Correlation with Medial Vowels	.12	.30	2.19	.01
Correlation with Del. Vis. Memory	.14	.22	1.81	.05

b) Perceiving medial vowels ( $r = .04$ )

c) Perceiving initial consonants ( $r = .07$ )

d) Pattern completion ( $r = .03$ )

e) Pattern copying ( $r = .01$ )

f) Matching rotated forms ( $r = .07$ )

5. The correlation between sentence comprehension and the ability to perceive reversals in words ( $r = .45$ ) is significantly greater than the correlation between sentence comprehension and the following:
  - a) Perceiving initial consonants ( $r = .24$ )
  - b) Matching words with similar configurations ( $r = .13$ )
  - c) Perceiving medial vowels ( $r = .17$ )
  - d) Letter matching ( $r = .09$ )
  - e) Form matching involving delayed visual memory ( $r = .04$ )
6. The correlation between word recognition with auditory clues and the ability to perceive word reversals ( $r = .27$ ) is significantly greater than the correlation between word recognition and matching words with similar configurations ( $r = .03$ ).





7. The correlation between form comparison ability at the end of the first grade and pattern copying is significantly greater ( $r = .36$ ) than the correlation between form comparison and the following:

- a) Letter matching ( $r = .07$ )
- b) Perceiving medial vowels ( $r = .12$ )
- c) Form matching involving delayed visual memory ( $r = .14$ )

When the correlations between form discrimination ability and reading ability were considered apart from the symbol discrimination ability and reading ability correlations it was evident from Table 6 that form matching involving reversals shows the strongest relationship to reading ability. Within the matrix of correlations for form discrimination only the following additional significant differences may be noted.

8. The correlation between paragraph reading and matching form reversals ( $r = .29$ ) is significantly greater than the correlation between paragraph reading and matching word configuration forms. ( $r = .14$ )
9. The correlation between sentence recognition with auditory clues and matching form reversals ( $r = .29$ ) is significantly greater than the correlation between sentence recognition and the following:
- a) Matching rotated forms ( $r = .07$ )
  - b) Pattern copying ( $r = .01$ )
  - c) Pattern completion ( $r = .03$ )



10. The correlation between sentence comprehension and matching reversed forms ( $r = .34$ ) is significantly greater than the correlation between sentence comprehension and matching forms involving delayed visual memory ( $r = .04$ ).

#### Summary of Differences in Correlations

Of all form and symbol discrimination abilities tested, the ability to detect reversals in words shows a significantly higher correlation with reading ability than certain other form and symbol discrimination abilities.

Of all form discrimination abilities, the ability to detect form reversals shows a significantly higher correlation with reading ability than certain other form discrimination abilities.

#### VISUAL DISCRIMINATION ABILITY, READING ABILITY AND MENTAL AGE

In Table 9 a trend toward a higher correlation between reading achievement and mental age is evident when compared with the correlation between reading achievement and visual discrimination ability. Five measures of reading ability reveal a higher correlation with mental age than with visual discrimination ability while two measures of reading ability, sentence comprehension and sentence recognition reveal a higher correlation with visual discrimination ability than with mental age.

The frequency of correlations with tests involving reversals may be noted in Table 9. Correlations between the Gates tests and the visual



TABLE 9  
COMPARISON OF READING ACHIEVEMENT  
CORRELATIONS WITH MENTAL AGE  
AND WITH VISUAL DISCRIMINATION ABILITY

Reading Achievement	Correlation with M.A. (Sept.)	Highest Correlation with Form Discrimination	Highest Correlation with Symbol Discrimination
Gates Word Recognition	.43	.36 Form Reversals	.38 Word Reversals
Gates Sentence Reading	.37	.29 Form Reversals	.32 Word Reversals
Gates Paragraph Reading	.46	.29 Form Reversals	.39 Word Reversals
Word Recognition Auditory	.33	.23 Form Reversals	.27 Word Reversals
Sentence Recognition Auditory	.21	.29 Form Reversals	.15 Word Config.
Sentence Comprehension	.32	.34 Form Reversals	.45 Word Reversals
Story Comprehension	.38	.23 Pattern Copying	.27 Word Reversals

discrimination tests follow a similar pattern in which the highest correlation is obtained with mental age while the next highest correlations are obtained with tasks involving reversals. Word Recognition (with auditory clues) and Story Comprehension also follow this pattern of relationship.

#### Summary

A comparison of the correlations obtained between reading ability and mental age with correlations obtained between reading ability and





form discrimination ability indicates a closer relationship between reading ability and mental age.

### SUMMARY OF FINDINGS

#### Performance on the Visual Discrimination Tests

1. Pupils entering the first grade encountered no difficulty in matching forms and letters.
2. Pupils experienced some difficulty in copying patterns and matching words.

#### Performance on Reading Tests

Mean scores agreed with Edmonton Public School norms established for these tests.

#### Relationship Between Visual Discrimination Ability and Reading Ability

1. A positive correlation was found between visual discrimination ability and reading ability, though the correlation coefficients obtained in this investigation were not of a magnitude required for predictive value.
2. The ability to perceive reversals in words produced the highest correlation with reading ability.
3. Matching letters and word form configurations and the test involving delayed visual memory showed a negligible correlation with reading.

#### Relationship Between Mental Age and Reading

Mental age produced a slightly higher correlation with reading ability than was obtained for the visual discrimination tests.



## Summary

This chapter has presented the mean scores for all tests administered in this investigation. Tables containing the following data were discussed:

- a) Correlations between reading ability and visual discrimination ability.
- b) Differences in correlations between reading ability and visual discrimination ability.
- c) Correlation between reading ability and mental age. The chapter concluded with a summary of the findings.



## CHAPTER V

### FINDINGS AND CONCLUSIONS

The purpose of this study was to investigate the relationship existing between visual discrimination abilities and reading ability. Tests constructed by the investigator were administered in September, 1962 to examine the ability of first grade pupils to see likenesses and differences. Results were used to determine the correlation with reading ability in June, 1963.

This chapter presents the conclusions drawn from the interpretation of the findings of this study. Implications arising from these conclusions are discussed. Suggestions and possibilities for further research are also presented.

### HYPOTHESIS I

There is no positive correlation between reading achievement and each of the visual discrimination abilities selected for this study.

The total number of correlations showing the relationship between visual discrimination abilities and reading ability was ninety-eight. Of this number fifty-two were significant while an additional twenty-seven correlations were low but positive. Eighteen correlations were almost zero but only one was negative. On the basis of this evidence, Hypothesis I is rejected.

The following conclusions are evident with respect to the positive correlations obtained between visual discrimination ability and reading ability:



## Form Discrimination

1. The ability to discriminate between forms does make a small contribution to the skills necessary for success in beginning reading.
2. Certain kinds of form discrimination appear to function in a manner not clearly defined. There was a negligible correlation between the delayed visual memory test and the reading tests. The task of remembering forms for a period of one day presented no difficulty to 39 per cent of the pupils as indicated by the perfect scores they obtained. If the ability to remember forms is a requisite for success in reading there is a possibility that this ability is acquired as an intrinsic part of the reading program. The negligible correlation found between reading ability and the test of word configuration forms may indicate that this ability as a factor in learning to read is similarly acquired.
3. Pattern copying and pattern completion were found to have higher correlations with paragraph reading, sentence comprehension and story comprehension. These findings would lead to the conclusion that pattern copying and pattern completion require a certain amount of reasoning ability similar to that employed in comprehension exercises in reading. Low correlations between pattern copying and completion and two tests involving auditory clues would indicate that these abilities





were less vital when the words were pronounced.

The highest correlation with pattern copying and completion is shown by form comparison but this correlation was not of sufficient magnitude to indicate a marked relationship. It may be further concluded that a number of pupils who experienced difficulty in the pattern copying and pattern completion tasks in September, 1962 attained greater success with the form comparison task in June, 1963 and conversely, a number of pupils who were successful with the September test were less successful with the June test. Thus it appears that the ability to compare forms had been learned by a number of pupils during the year.

The findings of this study are in agreement with the results of several investigations into the relationships between visual perceptual ability and reading ability. Correlations obtained in previous investigations correspond rather closely to correlations found in the present study. Gates (1926) found very low correlations between reading ability and the ability to match geometric patterns. Malmquist (1958) also found low correlations between the ability to match geometric forms and success in first grade reading.

The study which most closely resembles the present study was conducted by Goins (1958) who carried out a detailed examination of the relationship existing between various perceptual abilities and success in first grade reading. Pattern copying as tested by Goins was quite similar to the pattern completion test used in the present



study where correlations of .27 and .23 were obtained. Goins, who found pattern copying to have the highest correlation with reading ability, obtained correlations of .33 and .51. The results of the present study indicated that the test which contained form reversals had a higher correlation with reading ability than any test dealing with form discrimination. However, the test involving reversals of words produced the highest correlation of any test used.

In one instance a test designated by a different title required the pupil to perform the same task as in Test 11 (Figures) of the Goins' series and Form Rotation of the present study. As shown in Table 6 this test produces a correlation of .25 with word recognition and sentence comprehension as compared to .39 obtained by Goins. Some difference exists in the case of reversals. Goins in obtaining a correlation of .49 with reading ability tested only the ability to distinguish between pictures facing right or left but not including a rotation or complete reversal of the object. The major difference in the two studies is that Goins did not compare the correlations between visual perceptual abilities involving form discrimination with those involving symbol discrimination.

Two investigations have examined the relationship between reading ability and pattern copying as defined in the present study. At the third grade level, Justison (1963) found a correlation of .39 with vocabulary and .41 with comprehension on the California Reading Achievement Test when the relationship with pattern copying was examined. Also at the third grade level Glennon (1961) found a correlation



of .31 between pattern copying and reading ability. These correlation coefficients, while slightly greater than correlation coefficients found in the present study, show a similar degree of relationship. Coefficients obtained in the present study were .23 with paragraph reading, .27 with sentence comprehension, and .23 with story comprehension. The higher correlations found by Justison and Glennon may be accounted for by the difference in grade level. During the first years of school some pupils who may have been deficient in pattern copying ability may have become more proficient thus having the effect of increasing the correlation with reading ability.

Two facets of visual discrimination ability which have received little attention in other investigations are immediate visual memory and delayed visual memory. In the present study these tests were designed to investigate the correlation with reading ability of a pupil's memory for forms. A unique feature of these tests was the absence of printed symbols thus reducing to a minimum the effect of pre-school experiences with books and other reading materials. The findings of this study show a very low positive correlation between these abilities as measured in September, 1962 and reading achievement as measured in June, 1963. No evidence of similar investigations could be located for purposes of comparison. Thus it appears that little is known of the part played by visual memory in the process of learning to read.







## Symbol Discrimination

1. Word and letter matching ability make a greater contribution to success in the early stages of reading than is made by form discrimination ability. The most consistent relationship with reading ability appears in the four symbol matching tests involving letter reversals, initial consonants, medial vowels, and word reversals. The ability to be aware of these differences in letters and words is one for which higher correlations with reading would be expected for the reason that reading materials consist of words which must be recalled on the basis of such similarities or differences. Another factor expected to produce a markedly higher correlation between symbol discrimination and reading ability is the probability that many of the children used as subjects had had pre-school experiences involving letters and words. It would also be expected that these experiences would prove to be of definite value as an aid in developing a more acute awareness of the similarities and differences in words.
2. Letter matching is an ability which appears to be learned as an intrinsic part of the word recognition program by pupils unable to perform letter matching tasks in September. This conclusion is drawn from the evidence presented in Table 6. The extremely low or minus correlations found between letter matching performance and various reading skills indicate that this ability functions independently of the abilities used by



pupils in the early stages of learning to read. It was noted in the discussion following Table 3 that a standard deviation of less than one indicates that this task was a simple one for these pupils. From this evidence it may be concluded that most of the pupils in the sample population were capable of performing letter matching tasks as a result of pre-school experiences. It is also probable that letter matching ability may be concomitant with general ability although the correlation with intelligence and mental age is not substantial (Table 11).

3. The ability to select the correct word from a group of words having similar configurations makes a negligible contribution to success in first grade reading as indicated by the low correlations shown in Table 7. A low standard deviation of 1.03 again indicates that the task was not difficult and therefore it must be concluded that pupils did not rely on this particular ability in the reading tests. It may be further concluded that this method of word attack must be discarded in favor of methods which enable the pupil to make more refined discriminations involving initial, medial or final letters or syllables.

Correlations between word and letter matching and reading ability correspond to those obtained in other studies similar in design as follows:

Malmquist (1958) (letter matching)	.31
------------------------------------	-----



Durrell and Gavel (1958) (letter matching) .22

Gates (1940) (word matching) .45

Positive correlations found by other investigators, Smith (1928), Harrington and Durrell (1955) and Petty (1939), are not comparable in that standardized tests were not used to measure reading ability. The findings of the present study are in agreement with the three investigations of a similar nature.

## HYPOTHESIS II

There are no significant differences in the correlation between each visual discrimination ability tested and reading ability.

Hypothesis II is rejected on the basis of the results obtained when the differences between various pairs of correlation coefficients were tested for significance.

From the significant differences found between correlation coefficients (Table 6 and Table 7) the following conclusions may be drawn:

1. The ability to perceive reversals in words has a significantly higher correlation with word recognition ability than matching word configuration forms, letter matching, word configuration matching, pattern completion and pattern copying.
2. Various types of form discrimination tested showed no significant differences in the correlations obtained with word recognition and story comprehension. Thus the ability to discriminate in September between forms and pattern





details does not result in greater reading achievement in June.

3. One exception occurred in the case of sentence recognition with auditory clues where the test of form reversals had a significantly higher correlation than the tests of pattern copying, pattern completion and rotated forms. One other exception appeared in paragraph reading where form reversals had a significantly higher correlation than the test of word configuration forms.
4. In general, symbol discrimination correlates more closely than form discrimination with reading ability. One obvious explanation for this difference may be given on the basis of pre-school experiences. Symbol discrimination may be assumed to be a measure of the child's experiences with letters and words before entering school. This assumption would then lead to the expectation that the ability to discriminate between words and letters would show a substantial or high correlation with reading ability, but these correlations were not obtained. Thus it may be concluded that some children who do not possess these symbol discrimination skills in September are capable of acquiring these skills as part of the reading program.
5. The absence of high correlations between form discrimination ability and reading ability would lead to the conclusion that many of the pupils who were capable of performing well





on the form discrimination tests were not those who performed well on the reading tests. It may be further concluded that the ability to make these distinctions between forms exists to some extent independently of the discrimination abilities necessary for success in beginning reading.

### HYPOTHESIS III

There is no difference in the correlation between reading ability and mental age when compared with the correlations between reading ability and different visual discrimination abilities.

A definite trend is indicated in Table 9 toward a higher correlation between reading ability and mental age when compared to the correlation between reading ability and visual discrimination ability. Of seven measures of reading ability, five show a higher correlation with mental age than with visual discrimination ability as measured in this investigation. On the basis of this evidence, Hypothesis III is rejected.

The measures of reading ability failing to produce a higher correlation with mental age were three tests without picture clues. It may be concluded from this evidence that a careful analysis of the words in each test was necessary for success in this type of reading material. Since the test of sentence comprehension shows a substantial correlation with the test of word reversals it may be further concluded that the ability to look carefully at the words was of greater importance than the ability to comprehend the sentence.



The frequency with which the tests involving reversals appear to over-ride the relationship between reading and mental age suggests that the ability to detect reversals may be an independent ability.

This conclusion is in agreement with Krise (1949) who found that:

a considerably greater amount of time was required for the students to learn the reversible symbols than the non-reversible ones. .... It is believed that this difference in time can be attributed to the confusion in learning caused by the reversibility of the reversible symbols.

Although the subjects used by Krise in his study were university students, a similar situation appeared to exist as suggested by the results obtained in the present study. In the case of the university students a minimum level of intelligence might be assumed thus denoting the probability that the ability to note reversals may not be a factor in mental age.

#### SUMMARY OF CONCLUSIONS

There is a positive correlation ranging from a negligible to substantial magnitude between reading ability and visual discrimination ability. Negligible correlations with reading ability were found for matching forms derived from word configurations, matching forms involving delayed visual memory, matching words having similar configurations and simple letter matching. Low correlations with reading ability were found for matching rotated forms, pattern copying, pattern completion, and matching words involving differences in medial vowels and in initial consonants. Substantial correlations with reading ability were found for matching forms involving reversals, letter matching



involving reversals, and word matching involving reversals in words.

1. In general, there are no significant differences in the correlation of different types of form discrimination ability with reading ability.
2. Pattern copying and pattern completion are more closely associated with reading tests that require reasoning ability. Pattern copying and pattern completion show a negligible relationship with word recognition tests.
3. Word and letter matching ability makes a greater contribution to success in the early stages of reading than is made by form discrimination ability.
4. Letter matching is an ability already acquired by many pupils entering first grade. For others it appears to be learned in connection with the reading program.
5. The strongest and most consistent relationship with reading ability is shown by the ability to detect reversals in form and symbol matching.
6. The ability to perceive reversals in words shows a significantly greater correlation with reading ability than several other discrimination abilities tested.
7. Many pupils who lack form discrimination ability upon entering the first grade apparently acquire this ability during the year.
8. The ability to detect reversals may function as an independent ability.





9. Mental age makes a slightly greater contribution to success in reading than form and letter discrimination ability.

#### LIMITATIONS OF THE FINDINGS

This investigation served as a pilot study which forms part of a larger investigation dealing with reading readiness. Tests used in this investigation were constructed by the investigator to be used on an experimental basis. Test reliability and test validity were not established but a certain measure of content validity may be claimed. The basis for this claim is that tasks required of the pupil are similar to those contained in standardized tests supplied commercially for pupils of this age group. Certain aspects of these standardized tests were expanded to include several items pertaining to a specific type of visual discrimination ability. Thus it was possible to examine certain visual perceptual abilities in greater detail.

The test population used in this investigation was a representative sample selected from the first grade population. Thus the findings of this study may be applied to the first grade population of this city and to other similar urban areas.

#### IMPLICATIONS FOR THE TEACHING OF READING

The findings of this study are pertinent to two aspects of the teaching of reading. One aspect has to do with the first stage known as reading readiness. For two or three decades one assumption underlying many of the exercises designed to promote visual discrimination readiness



was that the ability to make gross discriminations between geometric forms would help the child to learn to make complex discriminations between words. This assumption is not supported by the findings of this study which shows the lack of a substantial correlation between form matching ability and success in reading. The implication here is that reading readiness exercises that develop form matching ability are of questionable value for normal pupils. Thus first grade teachers should restrict the use of form matching exercises to individual pupils requiring remedial work because of immaturity.

The findings of this study also indicate that word matching of a more complex nature involving word reversals, and to some extent differences in initial, medial and final letters, correlates more highly with reading than other abilities tested. It is further implied that it would be more profitable to teach first grade pupils to match words in order that they may acquire a skill which will later prove of value in learning to read.

Since all pupils who achieved well on the form and letter discrimination tests did not achieve to a corresponding degree on the reading tests, it appears that other factors affected the performance of these pupils. Auditory discrimination may have been one inhibiting factor while motivation or intelligence may have been factors contributing to an improved performance on the reading tests. If word matching ability is a concomitant learning of the word recognition program, the implication for teaching procedures is that word matching exercises do not require undue emphasis and that this kind of visual discrimination



ability may be learned in conjunction with word recognition activities.

The fact that pattern copying and pattern completion are more closely associated with reading exercises involving reasoning ability suggests that pattern copying and pattern completion might be used to some advantage as an exercise in following directions. In this capacity practice in these skills might make a contribution to a stage of general readiness for reading. It should be noted in this connection that the findings of this study do not support the theory that a transfer of training is made from form discrimination to reading ability. Therefore, in actual teaching situations, form discrimination exercises must have another specific purpose to be of value to the pupil.

The second aspect of the teaching of reading to which this study pertains is the predictive function of reading readiness tests or exercises. The fact that this study did not produce correlation coefficients of an order required for purposes of prediction raises the question of the nature of the visual discrimination ability necessary for success in reading. It has been shown that a number of pupils attained some success in reading without having first mastered the perceptual skills tested. The advantages to be gained by postponing formal reading lessons until the pupil is able to attain a high level of performance on visual discrimination tests may be questioned. The implication for teaching appears to be that the true value of visual discrimination exercises is in providing the pupil with suitable materials for learning to follow the kinds of directions which will be required of him when he learns to read. These materials may be used in





a non-reading situation to develop desirable attitudes toward learning. Thus the major emphasis would be on the attitudes developed while perceptual skills would be of secondary importance. The implications for the use of reading readiness work books appears to be that the visual discrimination exercises should be completed only as required by pupils who are immature in their ability to follow directions.

In summary the implications of this study suggest that a critical appraisal be made of several types of matching exercises found in current reading readiness work books.

#### SUGGESTIONS FOR FURTHER RESEARCH

The findings of this study have been used as a basis for stating implications for the teaching of reading. There are, however, several unanswered questions which might suggest further research as follows:

1. Experimental forms of pattern completion and pattern copying tests might be devised to determine the effect of an increased number of test items on the measurement of pattern copying and pattern completion ability. The effect of including more intricate patterns to be scored either right or wrong might also be examined. Correlations with reading ability might be examined using tests administered in September and again in June. Thus the development of pattern copying ability from September to June might be studied in September and again in June to determine the amount of growth in word matching ability and its relationship to reading ability.





2. Experimental forms of the word reversals test might include words of greater length, words containing letters in reversed order, and words containing reversals of single letters. These tests, if administered in September, January and June might be used to note differences in performance and in the correlation with reading achievement.
3. The form matching test involving delayed visual memory could be increased in difficulty by increasing the number of nonsense forms contained in each item. It would then be possible to examine the effect of more difficult test items.
4. Copying ability in September and its relationship to reading ability might be measured by having pupils copy series of nonsense forms as suggested in item three above.
5. Tests similar to those used in the present study but of greater difficulty as suggested above might be administered to first grade pupils during the month of October. During the weeks preceding the test a program specially designed to give all pupils appropriate experiences with printed materials could be presented. The effect of controlled pre-reading experiences might then be determined on the relationship between visual discrimination ability and reading ability. Formal reading experiences as a factor influencing the pupil's visual discrimination ability might be determined by administering the visual discrimination tests at intervals of three months during the year.



6. An item analysis of tests used in the present study might reveal specific difficulties.
7. Finally, the tests used in the present study might be administered to kindergarten children at intervals of three months to determine the level of performance attained by younger children and to examine the development of visual discrimination abilities.

#### CONCLUDING STATEMENT

The purpose of this study was to examine the correlation between certain visual discrimination abilities and reading ability. Other investigators had examined several of these abilities in relation to reading but had not attempted a comparison of several abilities. This study compared the correlation with reading ability of form matching, letter and word matching, and pattern copying and completion. In this study, also, certain types of visual discrimination involving rotations and reversals were isolated. The inclusion of a test of delayed visual memory was a feature of the tests used.

The findings of this study indicated that the ability to note reversals in letters and words was most closely connected with reading ability. From these results it was concluded that the most beneficial type of visual discrimination training for pupils at the pre-reading stage appeared to be exercises to develop the ability to look carefully at the details of words. It was also evident that for most pupils little emphasis should be placed on exercises involving form matching, pattern



copying or letter matching. This study has produced evidence that visual discrimination ability is related to reading ability.





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## APPENDIX



# INTERCORRELATIONS

## SEPTEMBER VISUAL DISCRIMINATION TESTS

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Form Rotation		.65	.31	.25	.31	.06	.47	.46	.22	.15	.37	.31	.32	.48
2. Form Reversals			.33	.24	.25	.04	.21	.38	.42	.04	.30	.28	.39	.47
3. Word Config. Forms				.42	.38	.19	.45	.20	.27	.20	.31	.26	.38	.44
4. Pattern Copying					.64	.15	.92	.18	.28	.30	.28	.30	.28	.42
5. Pattern Completion						.12	.85	.22	.23	.33	.17	.20	.42	.40
6. Delayed Visual Memory							.15	.12	.03	.01	.005	.03	-.02	.03
7. Total Form Discrim.								.17	.25	.48	.35	.38	.33	.52
8. Letter Matching									.14	.22	.30	.25	.08	.43
9. Letter Reversals										.10	.35	.13	.39	.50
10. Word Configuration											.29	.31	.30	.53
11. Initial Consonants												.47	.39	.76
12. Medial Vowels													.35	.73
13. Word Reversals														.73
14. Total Symbol Discrim.														

Significance of correlation coefficients

.17 = .05 level of confidence

.23 = .01 level of confidence





## JUNE READING ACHIEVEMENT TESTS

[illegible]



## VISUAL DISCRIMINATION TESTS

### Directions for Administering

FIRST DAY - Test 6. Matching Forms (using delayed visual memory clues).

Today we are going to learn about some animals. The names of the animals are not written like words. I'll show you a sign which means the name of the animal.

SHOW PICTURE AND CARD NO. 1.

Look at this!

This sign says 's h e e p'. Point to the card.

This sign says 's h e e p'.

SHOW PICTURE AND CARD NO. 2.

Look at this!

This says 'p i g'. Point to the card.

This says 'p i g'.

REPEAT WITH CARDS NO. 3. 'c o w'

4. 's q u i r r e l'

5. 'r a b b i t'

6. 'e l e p h a n t'

7. 'm o n k e y'

BEGIN AGAIN WITH CARD NO. 1. Show card.

This says 'sheep' (pause). What does it say? Wait while class replies 'sheep'.

CONTINUE WITH CARDS NO. 2 - 7.

FINAL PRESENTATION AT CONCLUSION OF TESTING PERIOD FIRST DAY.



Distribute Booklets and Markers.

Page 2 (Test 1) - Matching Rotated Forms.

(Help pupils to fold back page 2.)

Put your markers under the top row. (check and help)

Now draw a ring around the first little 't r e e'. Now look at all the other 't r e e s' in the top row and find another 't r e e' that is just like the first one. Draw a ring around it.

HELP PUPILS WHO DO NOT UNDERSTAND BUT DO NOT INDICATE MATCHING TREE.

Slide your marker down so you can see the row of 'f l a g s'. Draw a ring around the first flag. Now find another flag that is exactly like the first one and draw a ring around it.

Slide your marker down so you can see the row of 's h o v e l s'. Draw a ring around the first shovel. Now draw a ring around the other shovel that is just like it.

Slide your marker down so you can see the row of 'b a l l o o n s'. Draw a ring around the first balloon. Now draw a ring around the other balloon that is just like it.

REPEAT FOR: 'b l o c k s'

'u m b r e l l a s'

's k i p p i n g r o p e s'

'p e n c i l s'



FIRST DAYPage 3 (Test 2) - Matching Rotated and Reversed Forms.

Put your marker under the top row of 'f l a g s'. Draw a ring around the first flag. Now draw a ring around the other flag that is just like it.

Slide your marker down so you can see the row of 'c u p s'. Some of the cups are turned around. Draw a ring around the first cup. Now draw a ring around the other cup that is just like it.

Slide your marker down so you can see the row of 'b o a t s'. Draw a ring around the first boat. Now draw a ring around the other boat that is just like it.

REPEAT FOR: 's o c k s'

'm i t t s'

'c h a i r s'

'p a n s'

'f l o w e r s'





FIRST DAYPage 4. (Test 3) - Matching Forms (using immediate visual memory clues).

Put your marker under the top row of boxes.

SHOW CARD NO. 1. (Practice item)

Look at this picture.

Now find the one that is just like this one and draw a ring around it.

CHECK AND HELP PUPILS.

Slide your marker down so you can see the next row.

Look at this picture.

SHOW CARD NO. 2.

Now find the one that is just like this one and draw a ring around it.

CORRECT PUPILS IF THEY ARE NOT LOOKING AT RIGHT ROW.

REPEAT FOR CARDS NO. 3, 4, 5, 6, 7, 8, 9.

Pages 5, 6, 7, 8, 9, 10. (Test 4) - Pattern Copying.

Practice item.

Look at the top picture. Page 5.

You draw that picture.

CHECK AND HELP. ALLOW APPROPRIATE TIME. (No further help)

Look at the other picture. You draw that!

ALLOW APPROPRIATE TIME.

REPEAT FOR PAGES 6, 7, 8, 9, 10.



FIRST DAYPage 11 and 12. (Test 5)

Practice item.

Look at these first two pictures. DEMONSTRATE WITH BOOKLET.

Draw a line in this box so that these two boxes will look exactly alike.

CHECK AND HELP. ALLOW APPROPRIATE TIME. (No further help)

Look at these two circles. Make them look just alike.

Look at the two boxes. Make them look alike. You finish the picture.

Look at these two circles at the top. Make them look alike.

TURN PAGE.

Make the first two boxes look alike. You finish it.

Now make the other two boxes look alike. You finish the picture.

Look at these two strings of beads. See where a bead is missing on this string? (point) Draw the bead on this string where it is missing.

Look at these two (top right). More than one bead is missing. Fix this string of beads so that these two strings of beads are alike.

REPEAT FOR THE LAST TWO. COLLECT BOOKLETS.

FINAL PRESENTATION OF TEST 6.

USE CARDS ONLY -- NO PICTURES.

Show Card No. 1.



6.

Do you remember which animal this card means? or stands for?

(pause) 'S h e e p' is right. Let's say it: 's h e e p'.

CONTINUE WITH CARDS NO. 2. 'p i g'

3. 'c o w'

4. 's q u i r r e l'

5. 'r a b b i t'

6. 'e l e p h a n t'

7. 'm o n k e y'

END OF FIRST DAY'S TESTING.

## SECOND DAY

DISTRIBUTE BOOKLETS. INSTRUCT PUPILS TO LEAVE THEM AS PLACED.

Test 6 (to be completed on second day).

Yesterday we learned some signs. Do you remember? One was  
'r a b b i t', one was: 'e l e p h a n t'

's q u i r r e l'

'm o n k e y'

'c o w'

'p i g'

's h e e p'

These books today have the pictures of the animals and also the  
signs you learned but the animals are not in the right order.

Now turn your book over. (Page 8) Put your finger on the first  
sign at the top.

DEMONSTRATE. CHECK AND HELP.





Which animal did you learn for this sign?

WAIT FOR REPLY 's h e e p'.

Now join the 's h e e p' to this sign with a line.

Draw a line from the sign to the 's h e e p'.

CHECK AND HELP. (Practice item)

Look at the next sign. Think of the animal you learned for this sign but don't say it. Just draw a line to the right animal. (No further help)

Look at the next sign. Find the right animal and draw a line to it. Go ahead and finish the page.

AS SOON AS INDIVIDUAL PUPILS ARE FINISHED CIRCULATE AND TURN OVER BOOKS. TERMINATE WHEN APPROPRIATE.

## SECOND DAY

### Page 2, Test 1.

HELP PUPILS FOLD BACK PAGE.

Put your marker under the top line. Draw a ring around the first letter.

DEMONSTRATE BY POINTING TO FIRST LETTER. CHECK AND HELP.

Now find the other letter that is just like it, (NO HELP) and draw a ring around it.

IF PUPILS SEEM CAPABLE THEY MAY FINISH PAGE INDEPENDENTLY. IF NOT, FURTHER DIRECTIONS FOR ONE LINE MAY BE GIVEN.



8.

Page 3, Test 2.

REPEAT DIRECTIONS FOR PAGE 2.

Page 4, 5, 6, 7, Tests 3, 4, 5, 6.

REPEAT DIRECTIONS FOR PAGE 2 BUT SUBSTITUTE "WORD" FOR "LETTER".

COLLECT BOOKLETS BEFORE PUPILS HAVE AN OPPORTUNITY TO REVIEW PAGE

8.



# Visual Discrimination Tests

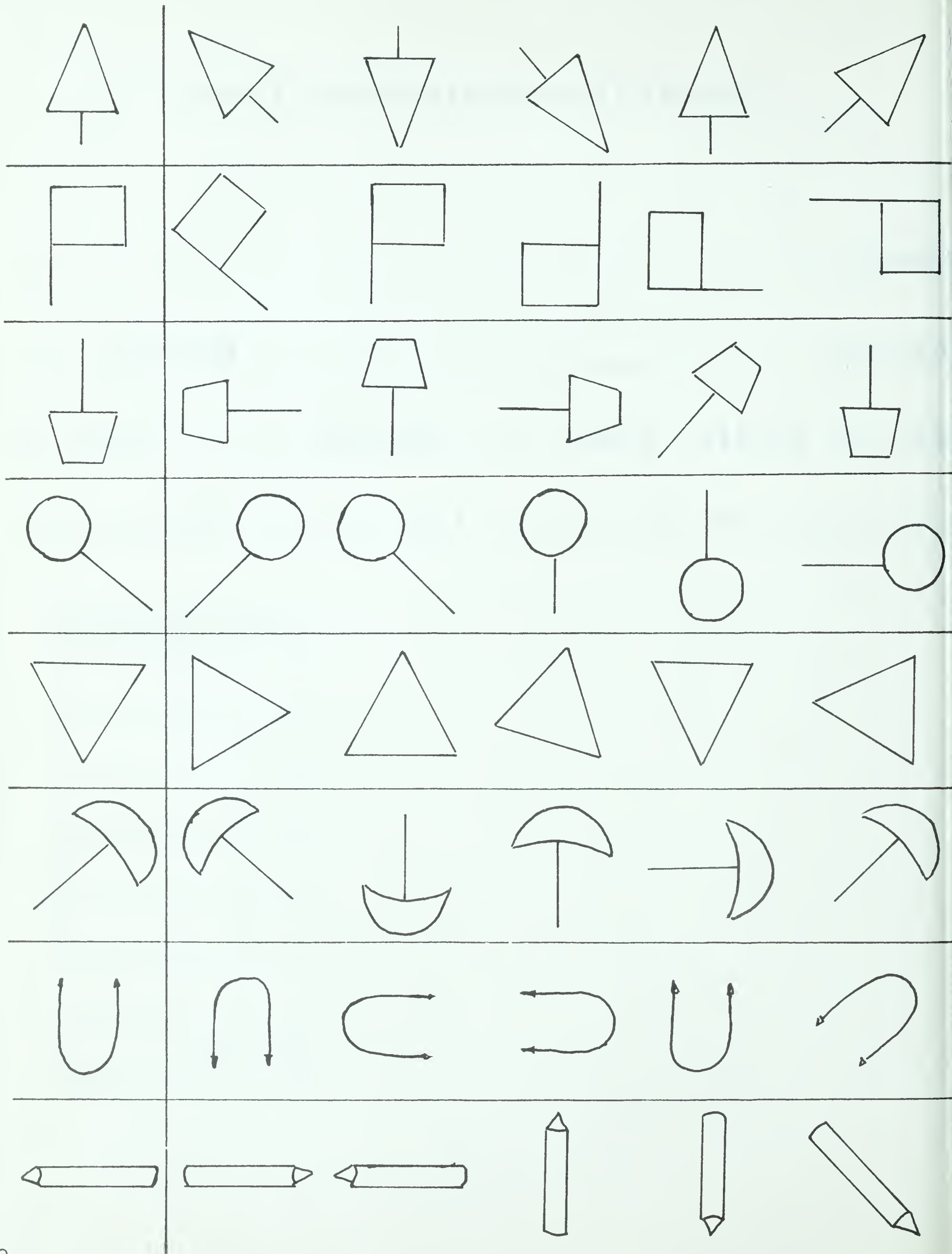
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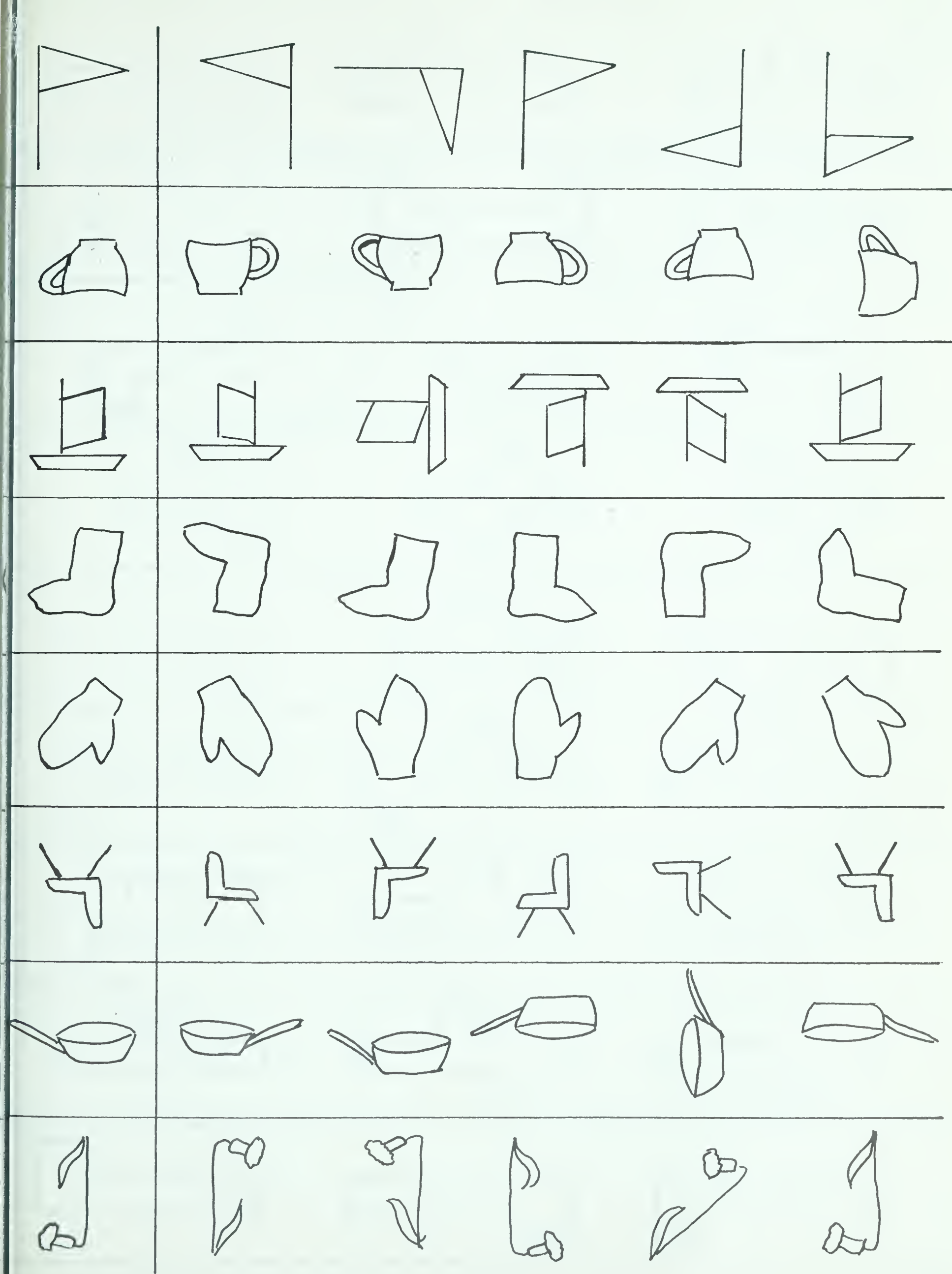
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Date of birth\_\_ Year\_\_\_\_\_ Month\_\_\_\_\_ Day\_\_\_\_\_

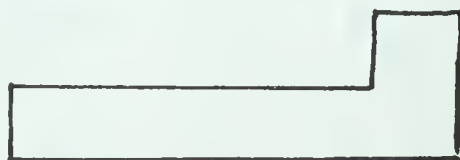
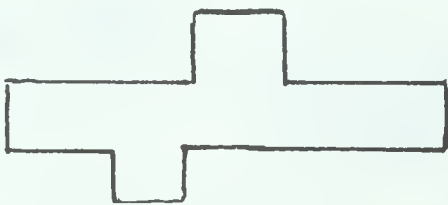
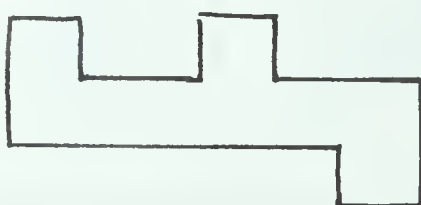
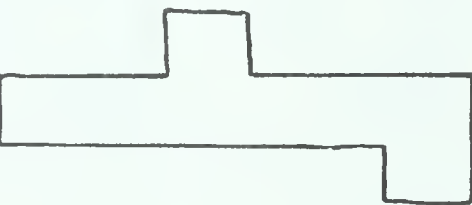
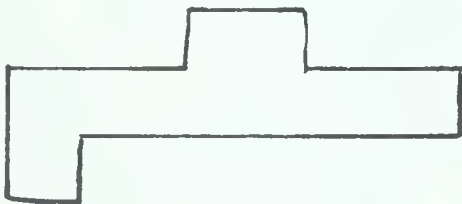
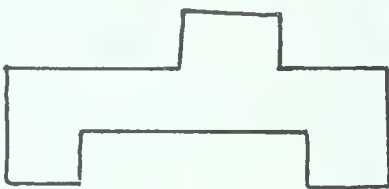
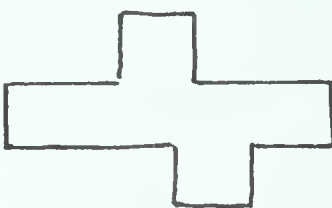
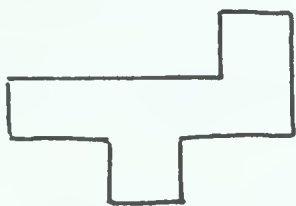
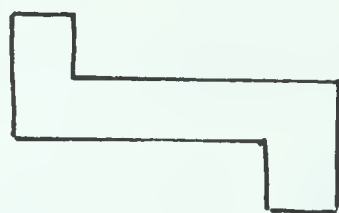
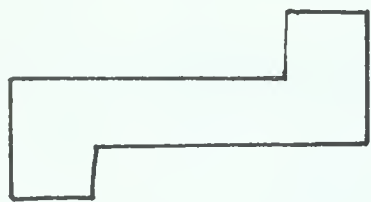
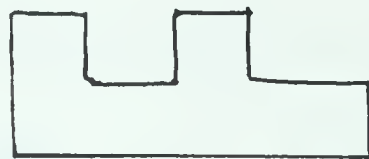
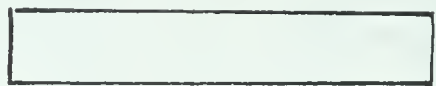
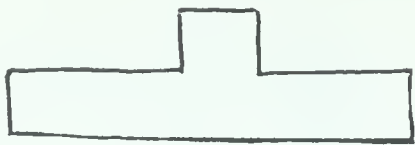
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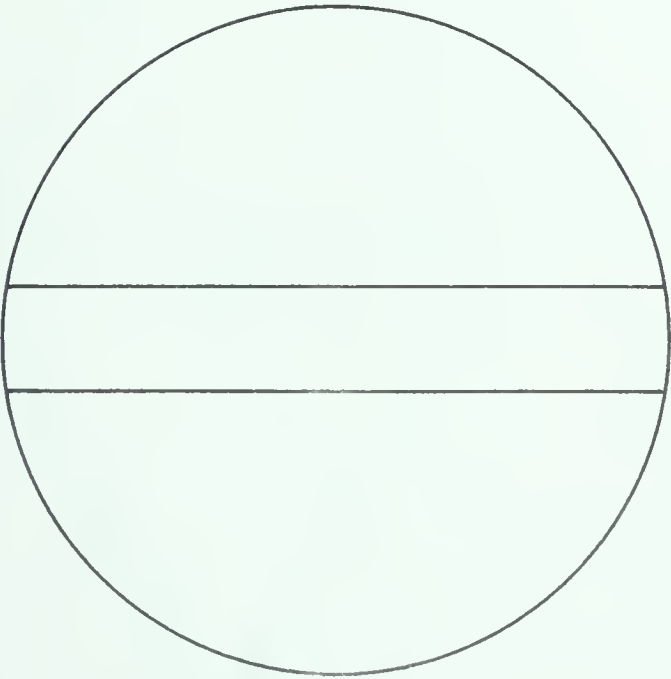
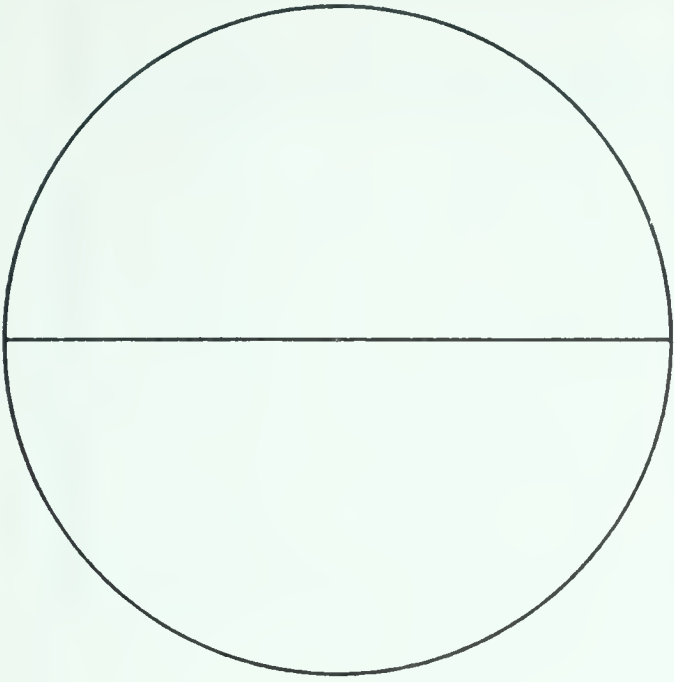
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2	
3	
4	
5	
6	
Total	

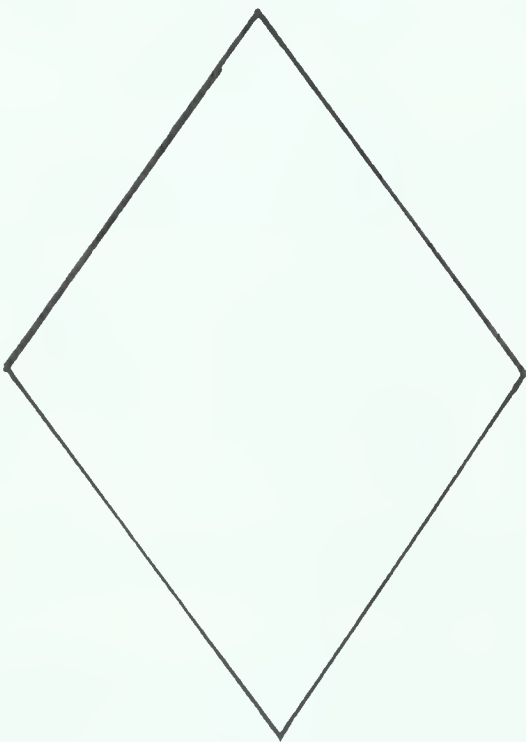
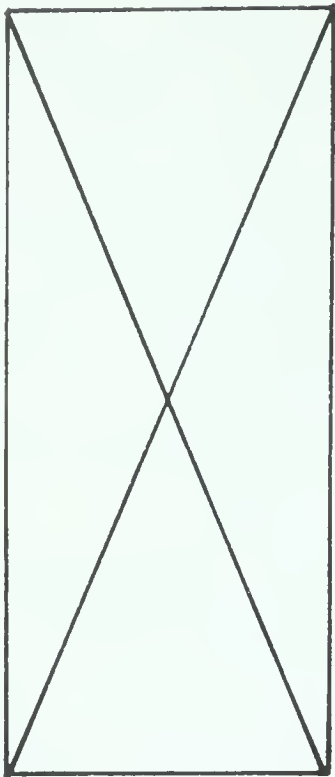


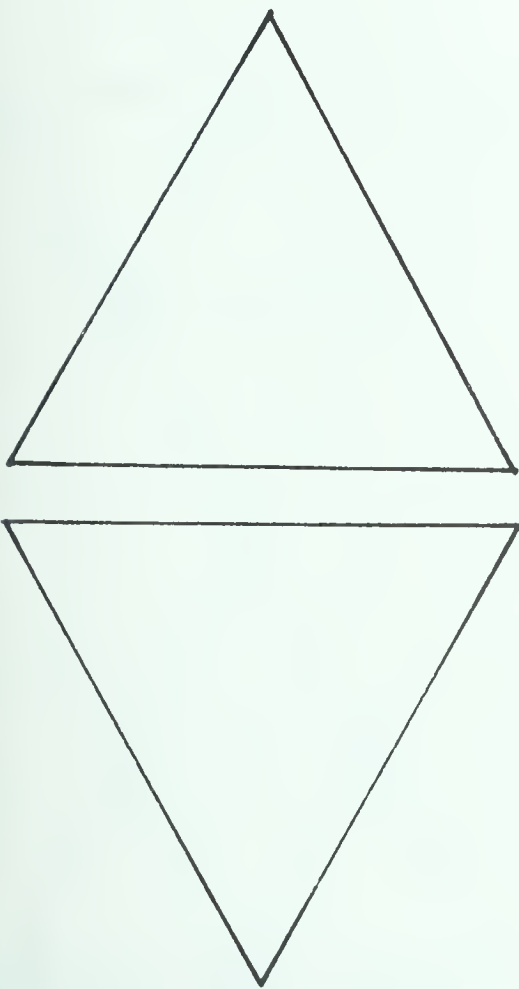
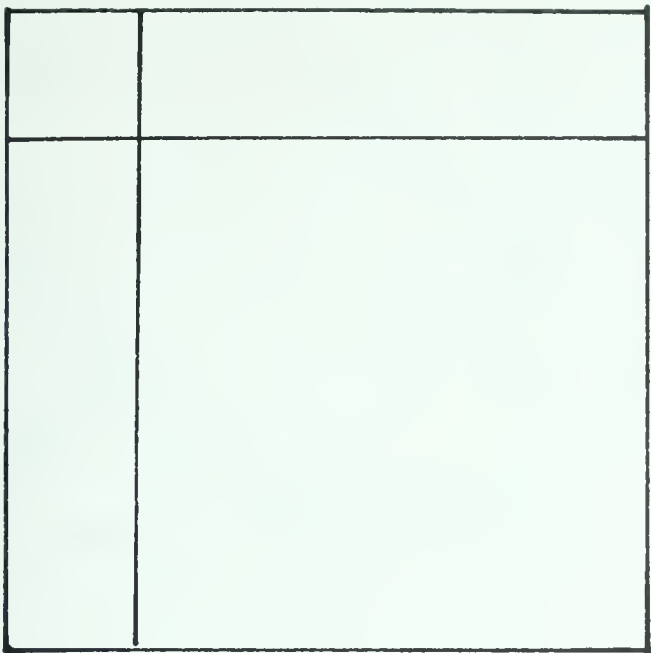


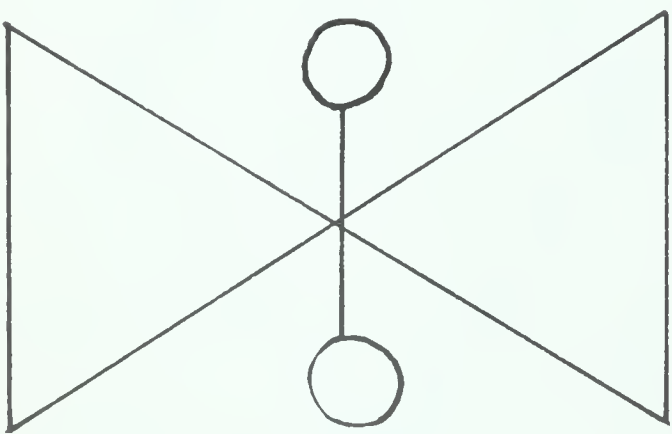
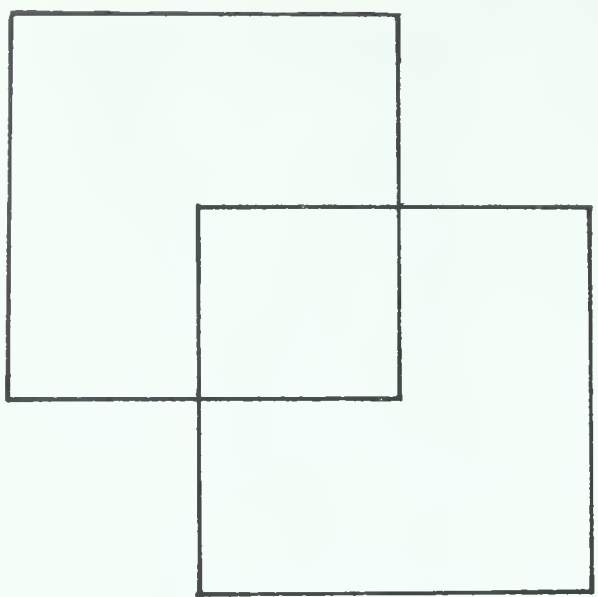


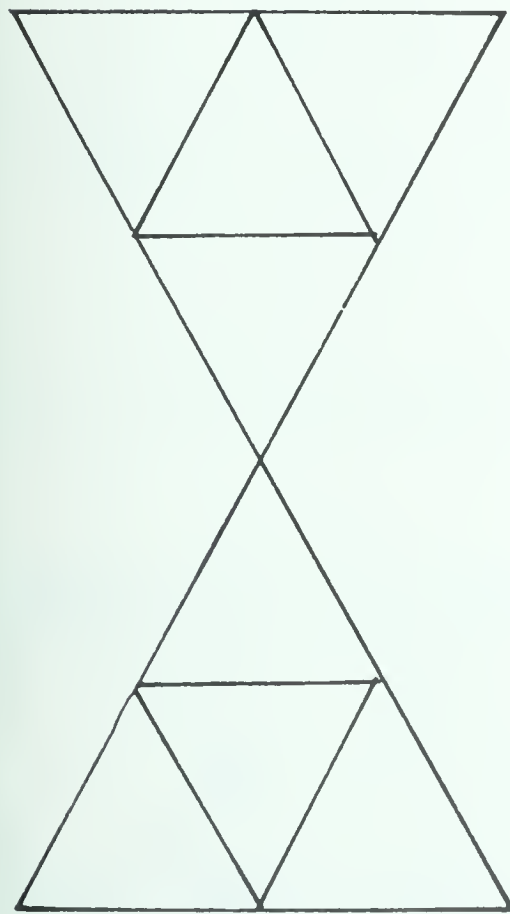
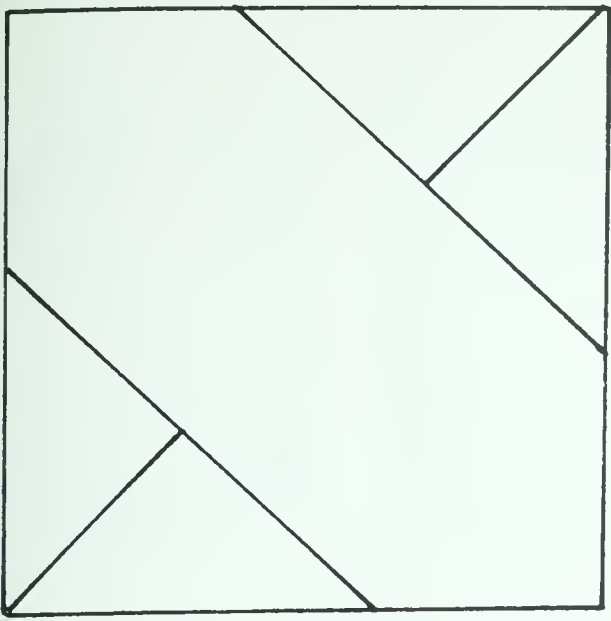


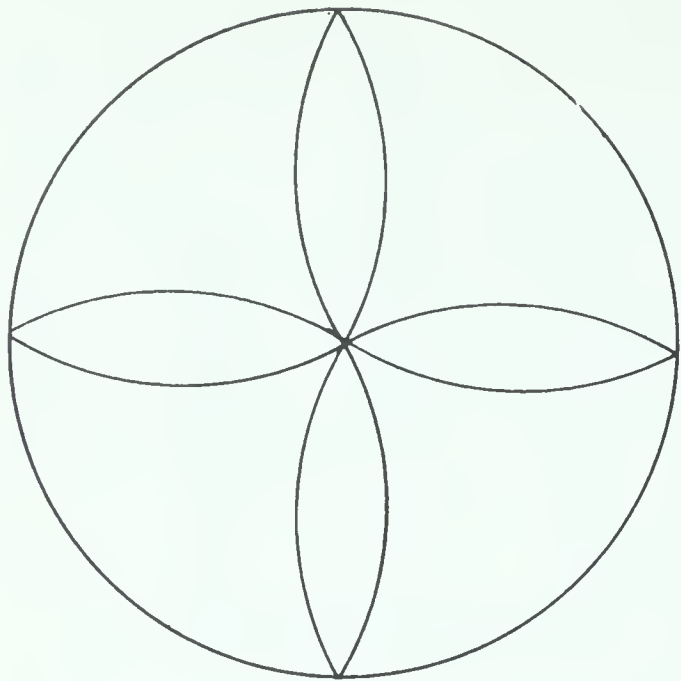






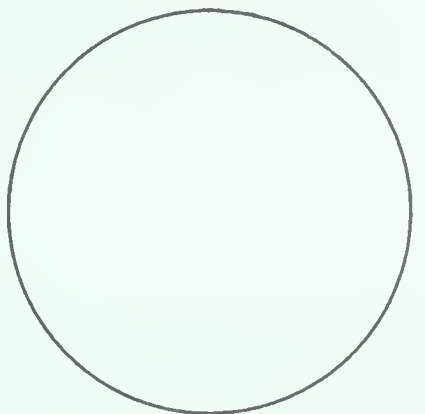
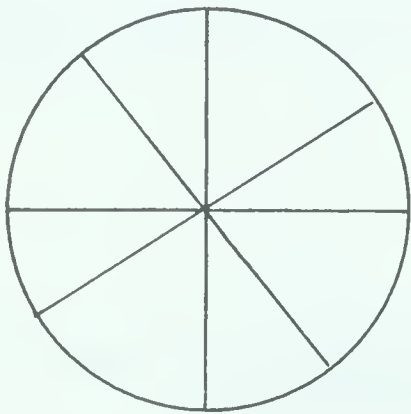
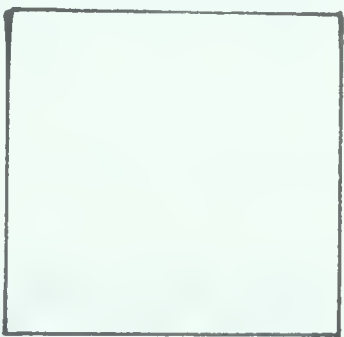
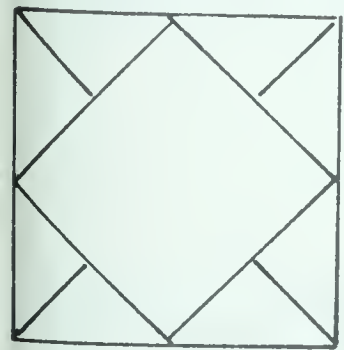
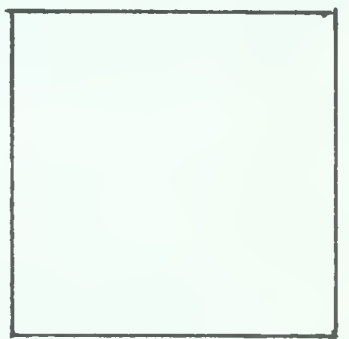
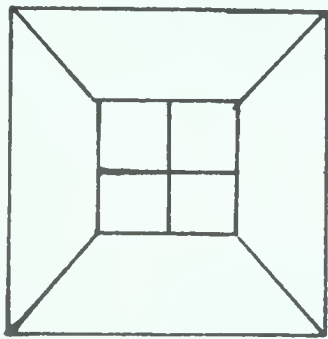
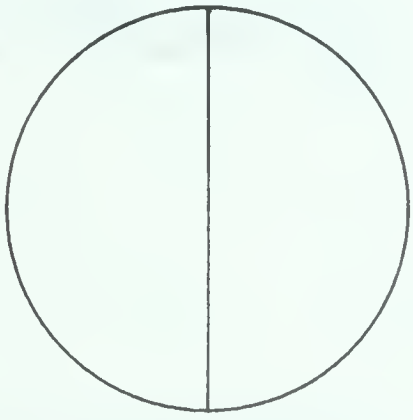
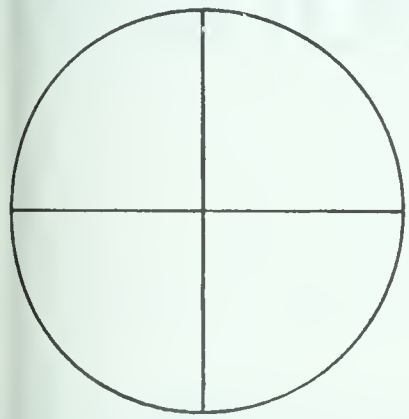
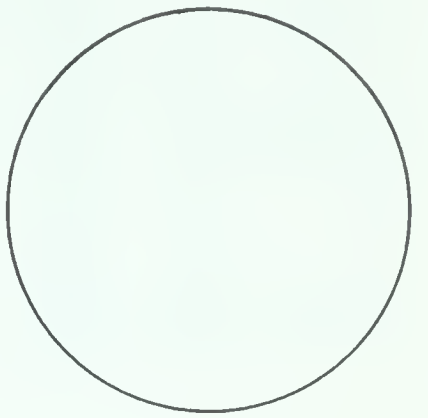
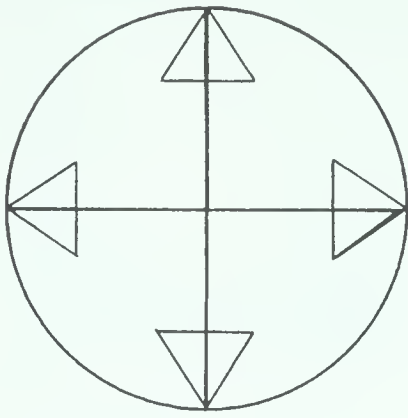
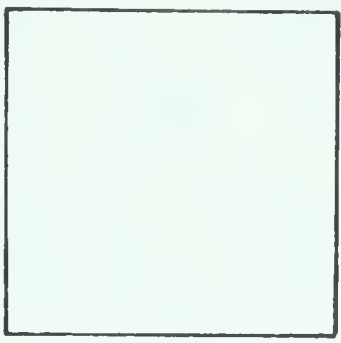
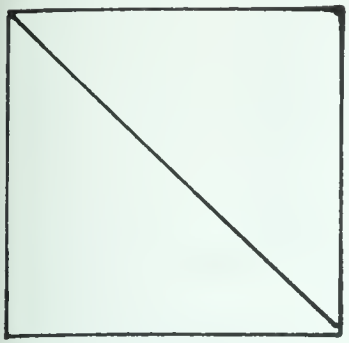


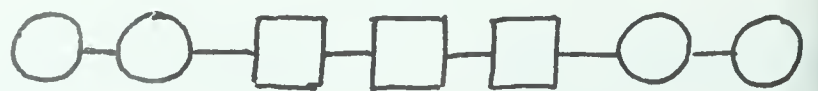
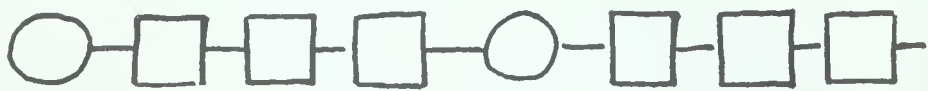
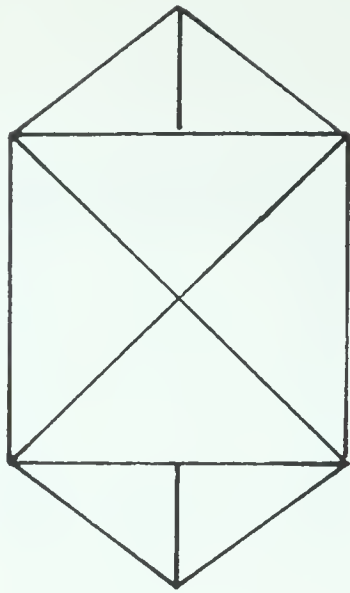
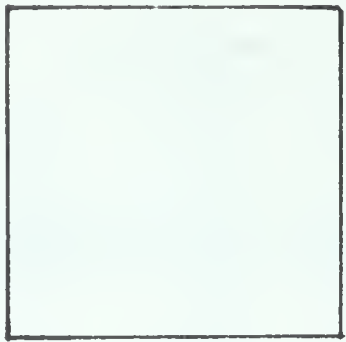
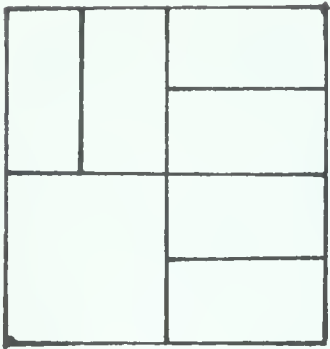




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# Visual Discrimination Tests

Name\_\_\_\_\_

School\_\_\_\_\_ Room\_\_\_\_\_

Date of birth Year\_\_\_\_\_ Month\_\_\_\_\_ Day\_\_\_\_\_

C.A.\_\_\_\_\_ M.A.\_\_\_\_\_ I.Q.\_\_\_\_\_ Sex\_\_\_\_\_

Test	Score
1	
2	
3	
4	
5	
6	
Total	

E	F E H K L T
F	E H F L T K
R	P B S R A K
Y	V W Y X M N
B	D P R S O B
D	P B R S O D
a	s c d a q e
b	h m n p r b
c	e d a c q s
m	n b h p m r
k	v w x y k f
r	m n h r p b
2	

b	c	a	q	d	p	b	
d	a	b	c	q	d	p	
m	n	u	r	j	m	c	
p	b	q	p	d	c	a	
r	j	u	c	r	m	n	
u	m	n	u	r	c	j	
C	D	C	G	K	Z	N	
D	C	G	D	N	Z	K	
K	Z	N	K	G	C	N	
W	M	V	Y	X	W	A	
A	V	M	W	A	T	L	
M	W	N	X	V	M	A	

come	ecom	come	meco
hop	kep	bge	hop
jumble	jumble	puddle	dledup
break	kreak	break	draek
drippy	driddy	yppad	drippy
traffic	fittant	traffic	ballric
pup	gup	puy	pup
Bick	Reak	Paah	Bick
Molly	Molly	Metty	Yollp
waves	sevaw	sevwa	waves

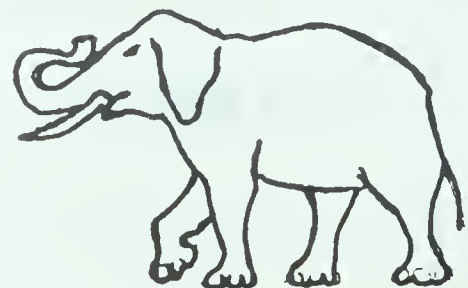
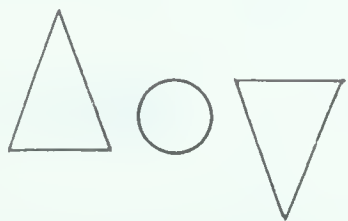
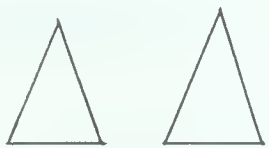
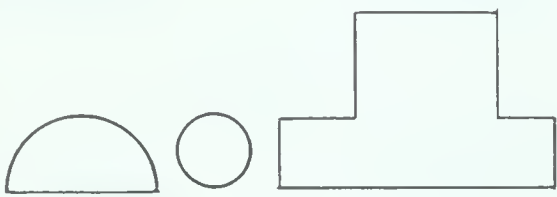
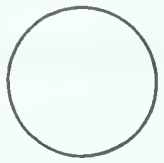
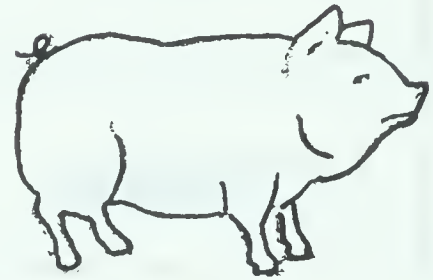
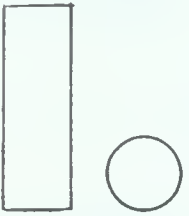
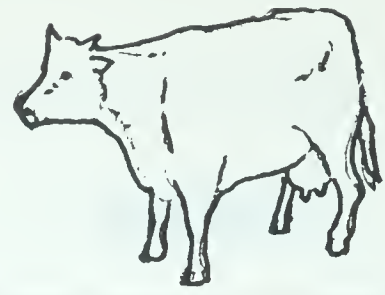


jump	hump	bump	lump	jump
run	can	man	ran	van
hill	pill	will	hill	till
boat	boat	coat	goat	float
sing	ring	king	wing	sing
mad	man	map	mad	mat
can	cat	can	cap	cab
lap	lab	lap	lad	lag
trip	trim	trill	trip	trick
wet	web	wed	well	wet



bed	bad	bed	bid	bud
rub	rib	rab	rub	rob
hat	hot	hit	hut	hat
spoon	spoon	spoun	speen	spea
cut	cat	cut	cet	cot
cap	cup	cop	cap	cip
bottle	battle	bottle	buttle	bettl
drip	drop	drup	drap	drip
silly	sully	sally	silly	soll
moon	moon	mean	mien	moun

saw	was	saw	mas
bull	dull	bull	llub
bed	deb	beb	bed
play	yalp	help	play
ban	ban	nab	dan
dot	pot	dot	bot
pat	tap	dat	pat
Carry	yrraC	Darry	Carry
Away	yawA	Away	yawV
Mat	Wat	taM	Mat



## SCALE FOR RATING PATTERN COPYING AND PATTERN COMPLETION

### GENERAL PRINCIPLES

#### Squares or Rectangles

To be awarded credit designated in the specific directions for each pattern, a square or rectangle:

1. must be a quadrilateral.
2. must have three fairly good right angles and the fourth angle must have a definite point where line changes direction. No credit is given for:

rounded corners



or ears.



#### Circles

No credit if there is a break in the circumference. No credit if lines do not meet.



No



Yes



No mark if more than half the circumference is distorted.

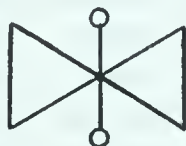
#### Triangles

Must have three angles and not more than three sides for credit.

#### Size (Pattern Copying Only)

2 marks credit if the vertical measurement of the figure is within 1/4" of original.

Exceptions:



and



measure width.

All figures are measured through centre when judging length or width. Measurement of right or left sides not considered.

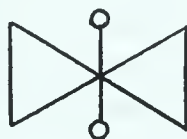




2.

1 mark credit for size if vertical measurement of figure is within  $3/4$ " (longer or shorter) of original.

Measure width for



and



Placement (Pertains to Pattern Copying Only)

Deduct one mark from total for test for each pattern showing total displacement on page.

### PATTERN COPYING

#### Test 4

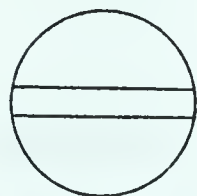
Total is 8 points per drawing. Size - 2 points.

Pattern detail (external and internal) - 6 points.

Placement - for total displacement of a figure, deduct one mark from test total.

Rotation - slight rotation not considered.

#### Pattern 1



1 mark if half the circumference is good. Add 1 mark if circumference is good in three quadrants with not more than a slight distortion in the fourth quadrant.

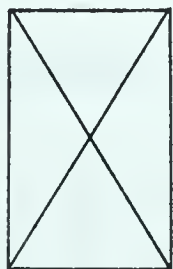
Allow mark if figure is slightly elliptical.

2 marks for any two lines obviously intended to be parallel.

Add 1 mark if lines are equidistant from centre.

Add 1 mark if space between lines is within  $1/16$ " larger or smaller than original. Take centre as point of measurement.

#### Pattern 2



1 mark for a quadrilateral with four angles approximately  $90^\circ$  (according to the general principles).

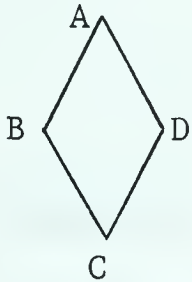
Add 1 mark if vertical sides are longer.

Add 1 mark if vertical and horizontal sides are within  $1/4$ " of correct length and width.

Add 2 marks if diagonals touch all four corners and bisect (approximately) each angle.





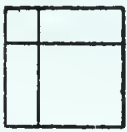
Pattern 3

2 marks for a quadrilateral obviously intended to be diamond shaped.

Add 1 mark if any 2 sides are equal.

Add 1 mark if any 4 sides are equal.

Add 2 marks if AC and BD are in a straight line if imaginary perpendiculars were erected through centre of figure.

Pattern 4

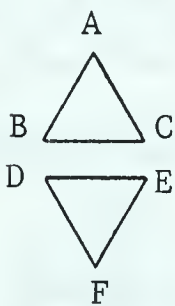
2 marks for quadrilateral with required angles.

Add 1 mark if 4 sides are equal. Allow 1/4" more or less.

Add 1 mark for presence of one horizontal and one vertical line not more than half distance from top side and left side. Lines must practically touch sides intended.

Add 1 mark if lines intersect at  $90^\circ$ .

Add 1 mark if intersecting lines are correct distance (allow 1/16" error) from left and top corner.

Pattern 5

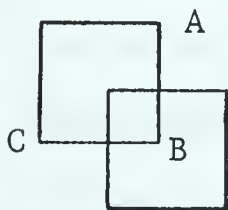
2 marks for triangles (1 for each - see general principles).

Add 1 mark if A and F are in a straight line, (that is, their apexes are opposite).

Add 1 mark if BC and DE are approximately equal in length.

Add 1 mark if space between BC and DE is correct in proportion to size of triangles.

Add 1 mark if BC and DE are parallel.

Pattern 6

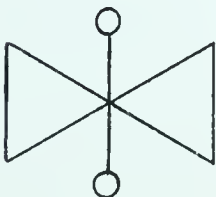
2 marks - one for each quadrilateral with required angles.

Add 1 if both quadrilaterals have equal sides. (approx.) Some variation in size of square is permitted.

Add 1 for any form of overlapping at corners, not more than half length of side of square.

Add 1 if AB is bisected.

Add 1 if CB is bisected.

Pattern 7

2 marks for two triangles placed thus: some rotation permitted.



Add 1 mark if triangles meet at centre.


Add 1 mark if section intersects at any angle.

Add 1 mark if section intersects at  $90^\circ$ .



卷一百一十五

卷一百一十五

Add 1 mark if balls on  are approximately correct size and correctly drawn. (Attached to it but not enclosing part of it.)

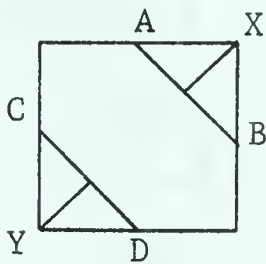
Yes



No



### Pattern 8



2 marks for a quadrilateral with angles.

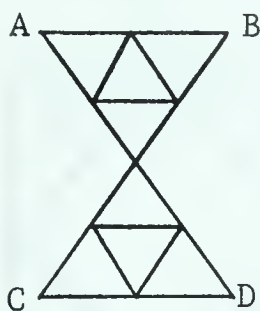
Add 1 mark if 4 sides are equal (i.e. within 1/4")

Add 1 mark if 4 lines are present at AB, CD and from corners X and Y to those lines.

Add 1 if placement of lines is correct in proportion to size of square (allow 1/16")

Add 1 mark if lines from X and Y corners meet AB and CD at 90° approximately.

### Pattern 9



2 marks - 1 for each triangle placed so: (some rotation allowed).

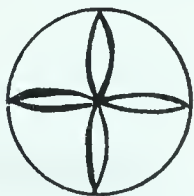


Add 1 mark if triangles touch at centre.

Add 1 mark for presence of 2 interior triangles (in approximately correct positions with apexes toward AB and CD).

Add 2 marks (1 for each) for small triangles touching all three sides of large triangle.

### Pattern 10



1 mark for the circle (be liberal).

Add 1 mark for each petal touching circumference and centre (shape of petal not considered) (4 marks)

Add 1 mark if all 4 petals are correctly shaped.

### Pattern 11



1 mark for a quadrilateral with required angles.

Add 1 if width and length are in proportion.

Add 2 marks if 4 horizontal lines (2 solid in centre and 2 dotted on either side are present)

1 mark for solid lines.

1 mark for dotted lines.

Add 1 mark if solid lines equidistant from centre, and space between is within 1/16" of original.

Add 1 if dotted lines are placed nearer horizontal sides of rectangle than to centre.

The first part of the paper is devoted to the study of the properties of the function  $f(x)$  defined by the equation  $f(x) = \int_0^x f(t) dt$ . It is shown that  $f(x)$  is a constant function, and its value is determined by the initial condition  $f(0) = 1$ .

In the second part, we consider the problem of finding the maximum value of the function  $f(x)$  on the interval  $[0, 1]$ . It is shown that the maximum value is attained at  $x = 0$  and is equal to 1.

The third part of the paper is devoted to the study of the properties of the function  $f(x)$  defined by the equation  $f(x) = \int_0^x f(t) dt$ . It is shown that  $f(x)$  is a constant function, and its value is determined by the initial condition  $f(0) = 1$ .

In the fourth part, we consider the problem of finding the maximum value of the function  $f(x)$  on the interval  $[0, 1]$ . It is shown that the maximum value is attained at  $x = 0$  and is equal to 1.

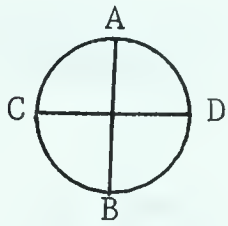
The fifth part of the paper is devoted to the study of the properties of the function  $f(x)$  defined by the equation  $f(x) = \int_0^x f(t) dt$ . It is shown that  $f(x)$  is a constant function, and its value is determined by the initial condition  $f(0) = 1$ .



RATING SCALE FOR PATTERN COMPLETION

## Test 5

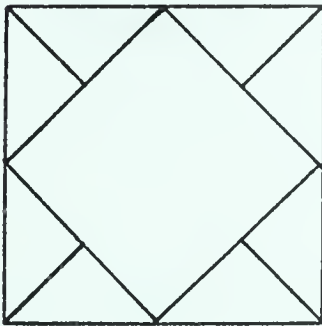
Total is 6 points for each pattern.

Pattern 1

2 marks for presence of any diameter.

Add 2 marks if diameter is in a horizontal position intersecting AB at any angle.

Add 2 marks if CD bisects AB at  $90^\circ$ .

Pattern 2

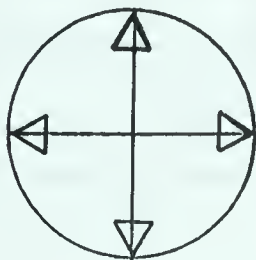
1 mark for any diamond (size and spacing not considered).

Add 2 marks for any 4 connecting lines from diamond to corners of square.

Add 1 mark if all four connecting lines bisect (approximately) sides of inner diamond.

Add 1 mark if 2 corners of diamond touch sides of square.

Add 1 mark if 4 corners touch sides of square.

Pattern 3

1 mark for 2 diameters (touching circumference not considered).

Add 1 mark if diameters intersect at centre at  $90^\circ$ .

Add 1 mark for any two triangles added to diameters.

Add 1 mark for 4 triangles added to diameters.

Add 1 mark if 2 triangles are approximately correct - size, touch circumference, and have diameter passing through triangle.

Add 1 mark if all 4 triangles qualify.

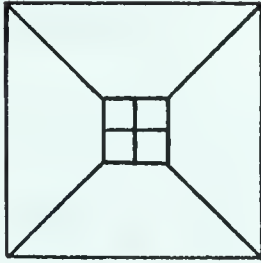
Pattern 4

1 mark for any interior quadrilateral (size and spacing not considered.\*)

\* See general directions.

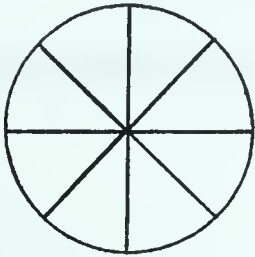




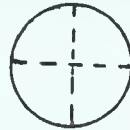


Add 1 mark for 2 connecting diagonals from corner of small square to corner of large square.  
 Add 1 mark for 4 connecting diagonals.  
 Add 1 mark for one line bisecting small square.  
 Add 1 mark for two lines bisecting small square (approximately).  
 Add 1 mark if size of small square is approximately correct.

### Pattern 5

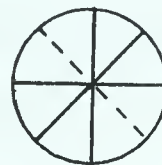


2 marks - 1 each for one horizontal and 1 vertical diameter:



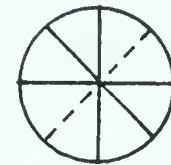
All diameters must be continuous through centre with no change of direction at centre.

Add 1 for:



(dotted lines)

and 1 for

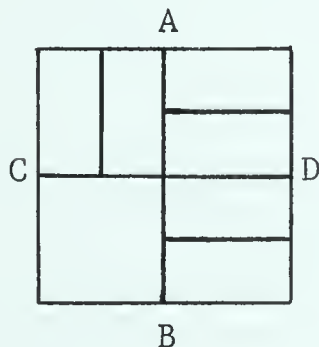


(bisects approx.)

Add 1 if - no extra diameters are added.

Add 1 if all 4 diameters pass through centre as determined by pupil.

### Pattern 6



AB and CD must be continuous. No credit for half a line.

1 mark for AB )  
 1 mark for CD ) Bisects sides (approximately)

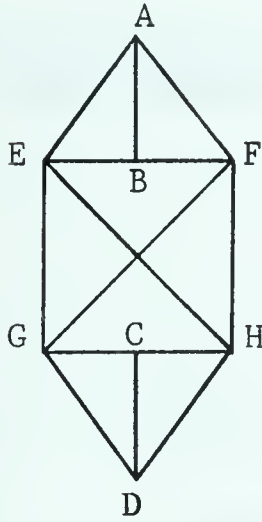
Add 1 mark for each line bisecting (approximately) quarters as on model square (three altogether).

Add 1 if no extra lines are added.

No credit for bisecting if AB and CD not continuous.





Pattern 7

1 mark for the diagonals EH and FG (no half marks).

Add 1 mark for triangle EAF (should not be merely a continuation of sides of square).

Add 1 mark for triangle GDH.

Add 1 for AB at any angle.

Add 1 for CD at any angle.

Add 1 if CD and AB are approximately perpendicular to sides of square.

Patterns 8, 9, 10 and 11 - BEADS

2 marks for each correct and complete response.

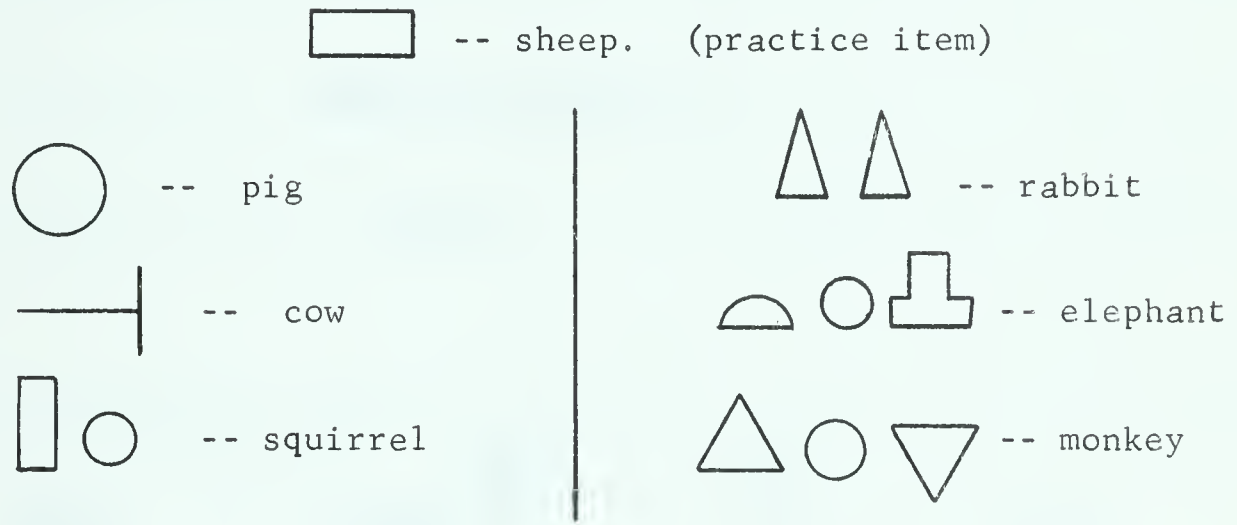
(Size and spacing not considered)

No partial marks - right or wrong.

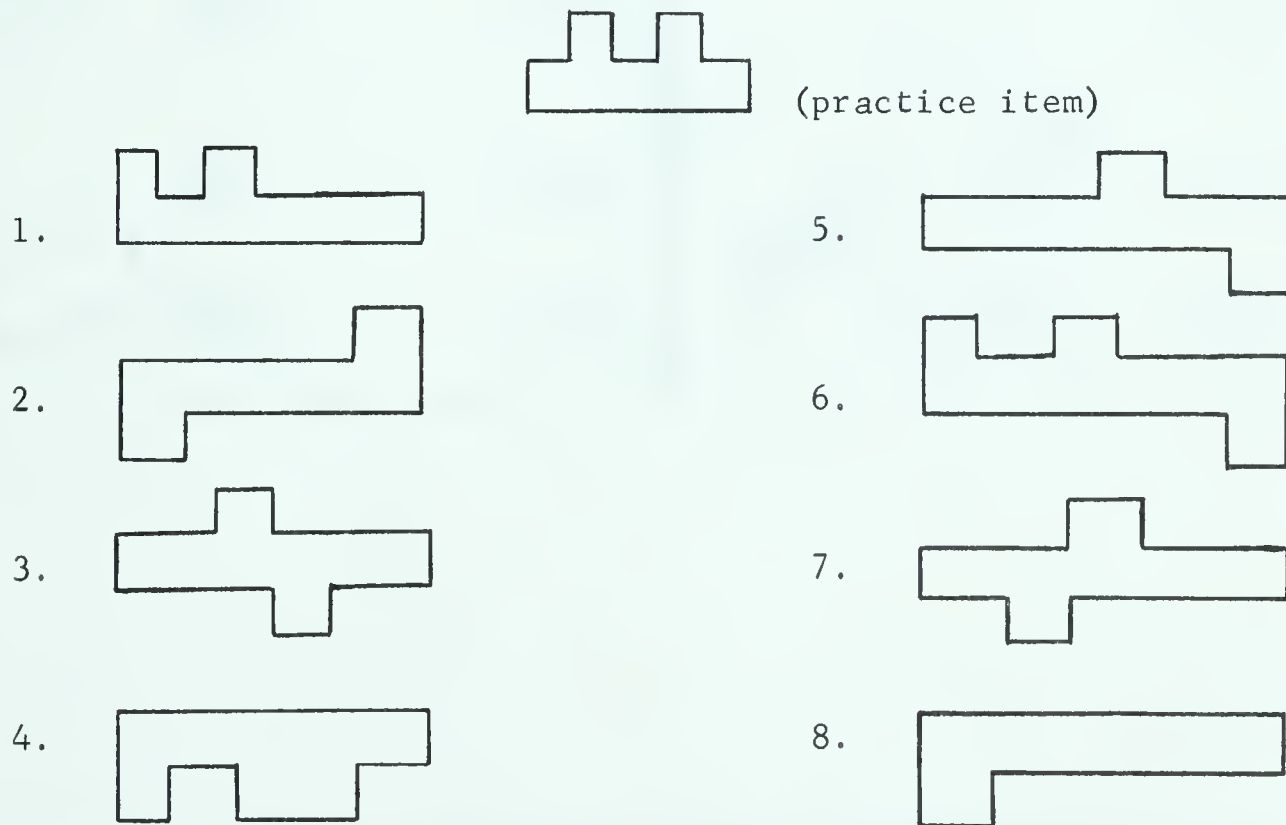


KEY FOR SCORING

Page 8, (Test 6) - Form matching using delayed visual memory clues.



Page 4, (Test 3)





GATES PRIMARY READING TEST

TYPE PWR  
FORM 3

For Grade 1 and Grade 2 (First Half)

Type PWR. Word Recognition



BUREAU OF PUBLICATIONS • TEACHERS COLLEGE • COLUMBIA UNIVERSITY  
525 West 120th Street, New York 27, N. Y. Copyright, 1958, by Arthur I. Gates

Write your name here.....

How old are you?.....When is your birthday?.....

School.....Grade.....Date.....

1.



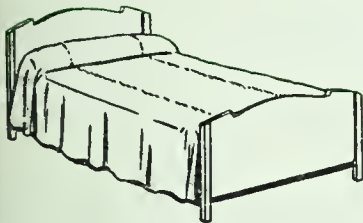
did egg  
dog two

3.



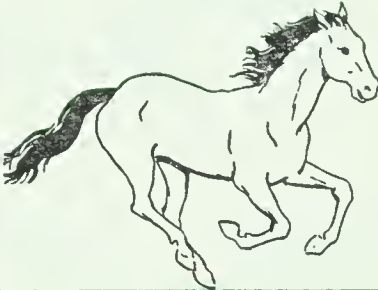
may make  
come milk

2.



be bed  
bag she

4.



horse play  
hose house

To the teacher: Detailed instructions for administering and scoring this test are given in the Manual (included in each test package).

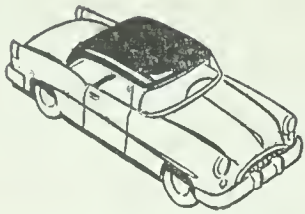
Number correct..... Number wrong..... Raw score (correct minus 1/3 wrong).....

Number tried.....(possible 48) Reading grade..... Reading age.....

Be sure to signal STOP at the end of 15 minutes.



1.



leg

men

car

fly

2.



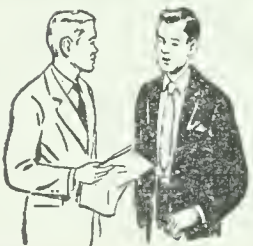
hid

six

pig

hat

3.



new

men

sled

ten

4.



boat

good

bowl

corn

5.



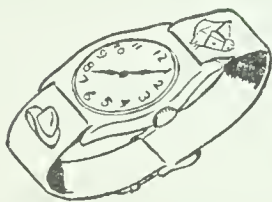
shoe

house

hour

mouse

6.



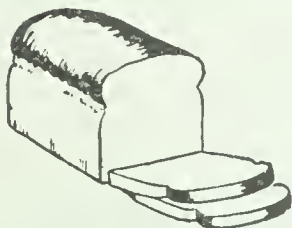
watch

water

night

house

7.



drink

green

broom

bread

8.



goes

drink

dress

blue

9.



clock

would

wolf

work

10.



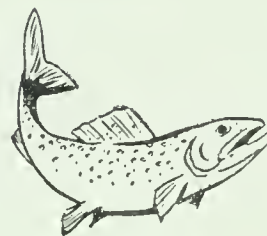
boat

gone

goat

road

11.



fish

duck

town

dish

12.



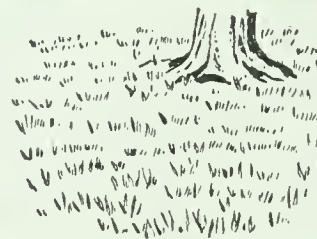
cent

sing

six

sled

13.



mouse

great

pussy

grass

14.



paper

sugar

paint

right

15.



mouse monkey

window money

16.



splashing stocking

standing something



17.



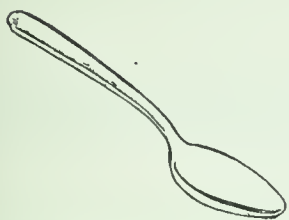
ran

cry

hop

cap

18.



soon

spring

spoon

moon

19.



pussy

pony

money

puppy

20.



star

moon

rope

read

21.



once

nest

does

nose

22.



stick

stop

store

shoe

23.



games

garden

kitten

gates

24.



bed

pet

set

not

25.



clothes

clouds

others

clover

26.



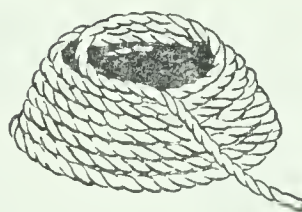
child

think

dolls

chick

27.



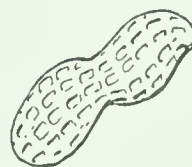
rock

ride

rose

rope

28.



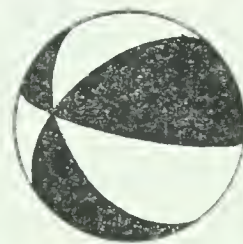
peanut

piano

pupil

pencil

29.



round

room

road

found

30.



riding

reading

hiding

raining

31.



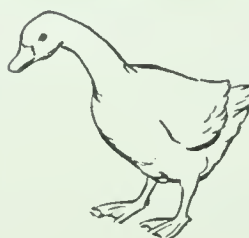
minute

kitten

mitten

miller

32.



goose

goes

goody

loose

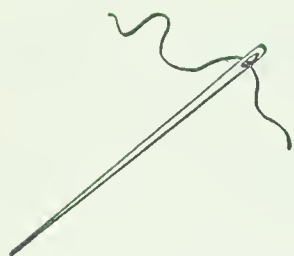
33.



pumpkin    napkin

pumping    punches

34.



needle    nibble

needed    handle

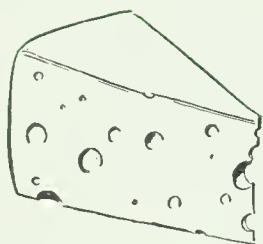
35.



nail    salt

mail    sail

36.



geese    cherries

cheese    guess

37.



card    hard

cart    care

38.



grass    grapes

grind    shape

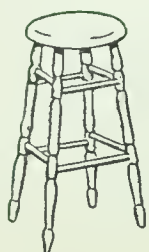
39.



bow    doll

cold    bowl

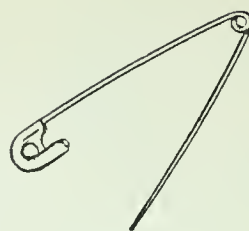
40.



stool    stood

stone    tool

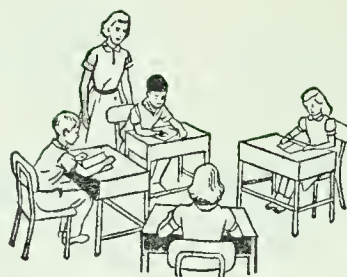
41.



pen    pan

pin    den

42.



grass    close

cloth    class

43.



donkey    doctor

dollar    double

44.



wing    swim

swing    smile

45.



bubble    battle

bottle    bottom

46.



stone    stamp

strong    string

47.



smoke    smile

smell    while

48.



branch    bridge

brings    hedge




GATES PRIMARY READING TEST

TYPE PSR  
FORM 3

For Grade 1 and Grade 2 (First Half)

Type PSR. Sentence Reading

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525 West 120th Street, New York 27, N. Y. Copyright, 1958, by Arthur I. Gates

Write your name here.....

How old are you?.....When is your birthday?.....

School.....Grade.....Date.....

This is a cat. I



This is a book. II



This is a cup. III



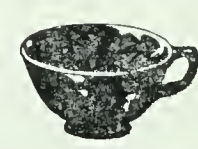
The girl has a book. I



The cup is white. II



The cat has a ball. III



To the teacher: Detailed instructions for administering and scoring this test are given in the Manual (included in each test package).

Number tried.....(possible 45) Raw score (number of sentences correct).....

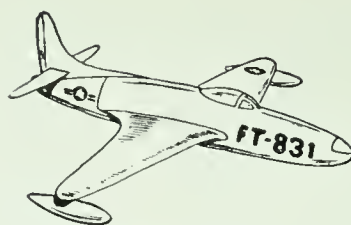
Reading grade..... Reading age.....

Be sure to signal STOP at the end of 15 minutes.

This is an airplane. I

This is a barn. II

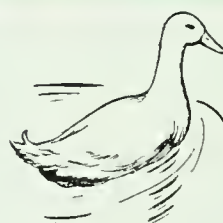
This is a spider. III



The duck swims. I

The bird flies. II

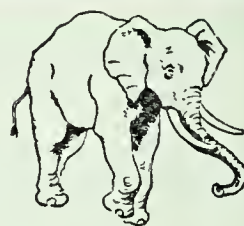
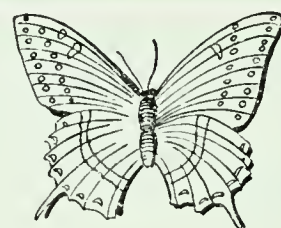
The duck drinks. III



The woman has three books. I

This is a picture of a butterfly. II

This is a picture of an elephant. III



The window is closed. I

The girl has a kitten. II

The top is spinning. III



The boy has a bicycle. I

The girl has a basket. II

The child is hiding. III





The clown is funny. I

The woman is singing. II

The squirrel has a nut. III



The child writes. I

The kitten drinks. II

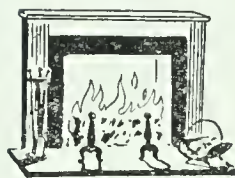
The child dances. III



The teacher has a feather. I

The girls like to paint. II

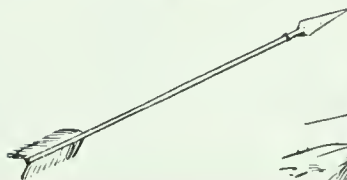
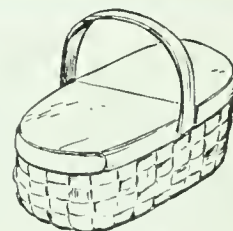
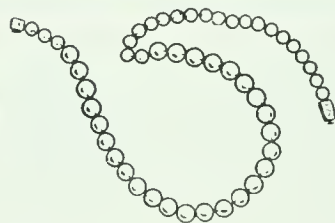
This fireplace is very warm. III



This is an apron. I

This is a basket. II

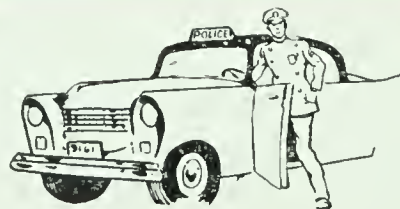
This is a haystack. III



The policeman has an automobile. I

The puppy is awake. II

The barrel is full of nails. III





The grocer sells fruit and vegetables. I

This is a beautiful moonlight night. II

The barnyard is near the stream. III



The princess is eating porridge. I

Here are the scissors and needles. II

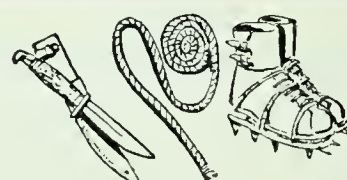
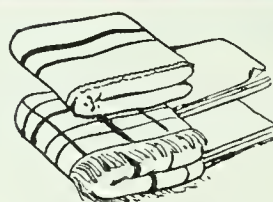
Father is planting potatoes. III



This is an attic bedroom. I

Here are blankets and sheets. II

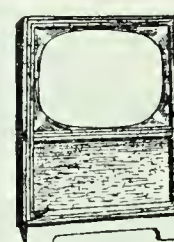
Brother is weeding the garden. III



The man has a rake. I

This is a picture of a cabin. II

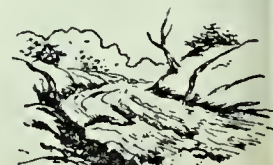
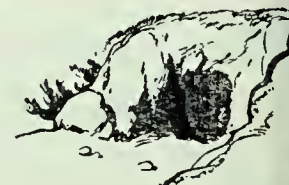
This is a picture of a shoemaker. III



This is the mouth of the cave. I

The hunter shoots the wolf. II

This is a swift rushing brook. III



# GATES PRIMARY READING TEST

For Grade 1 and Grade 2 (First Half)

TYPE PPR

FORM 3

## Type PPR. Paragraph Reading

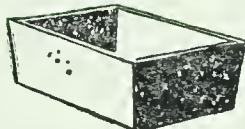
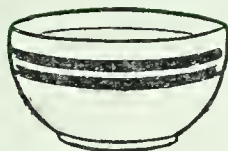


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525 West 120th Street, New York 27, N. Y. Copyright, 1958, by Arthur I. Gates

Write your name here.....

How old are you?.....When is your birthday?.....

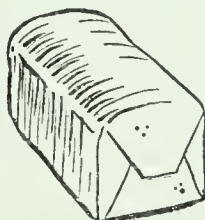
School.....Grade.....Date.....



1. Put an X on the ball.



3. Draw a line under the little book.



2. Put an X on the milk bottle.



4. Draw a line from the pig to the tree.

To the teacher: Detailed instructions for administering and scoring this test are given in the Manual (included in each test package).

Number tried.....(possible 26)

Raw score (number of sentences correct).....

Reading grade.....

Reading age.....

Be sure to signal **STOP** at the end of 20 minutes.





1. Put an X on the cup.

1

2

2

2. Put an X on the big two.



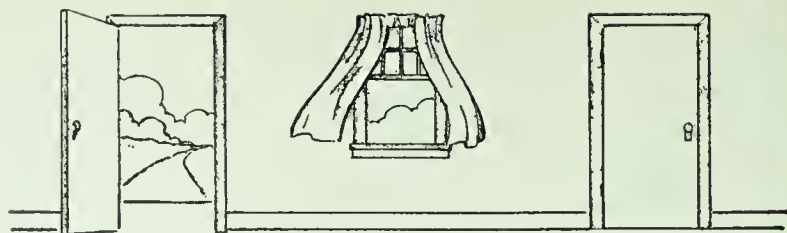
3. Draw a line under the black horse.



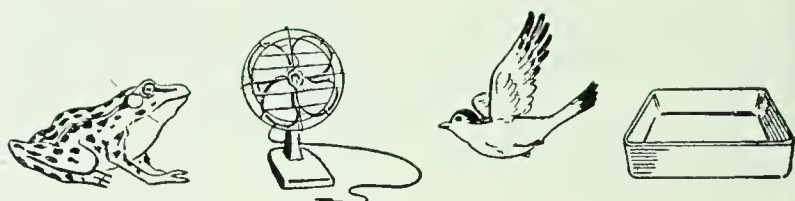
4. Put an X on the bird that is flying.



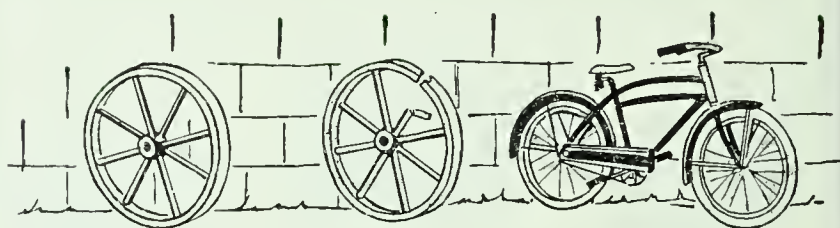
5. Draw a line under the four pigs.



6. Draw a line under the open door.



7. Put an X on the fan.



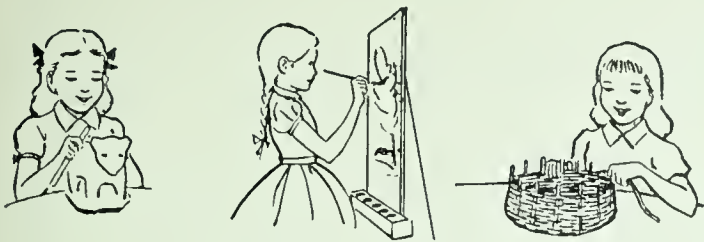
8. Draw a line under the wheel that is broken.



9. Put an X on the chicken that is eating.



10. Put an X on the girl who has a sled.



11. Put an X on the girl who is painting a picture.



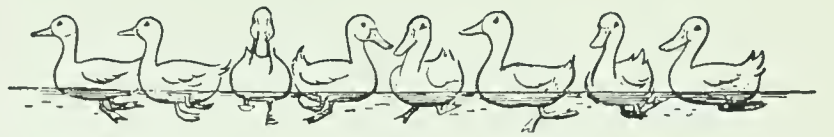
12. Draw a line from the squirrel to its nest. You will find the nest in the tree on the right side of the picture.



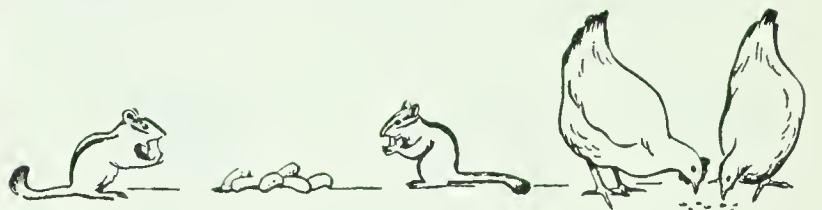
13. The deer and the chipmunk live in the woods. The turtle lives by the water. Draw a line under the one that lives by the water.



14. A kitten likes to drink milk. This kitten is thirsty. Draw a line from one of the kittens to the milk.



15. Here are eight little ducks. Draw a line under the feet of three of these ducks.



16. Chipmunks like to eat nuts. Draw a line from one of the chipmunks to the nuts.



17. These children like their art class. Some children draw, some model with clay, or paint. Put an X on the one who is modeling clay.



18. My brother is painting our new barn red. He is using a very wide brush. Put an X on what he uses to paint the new barn.

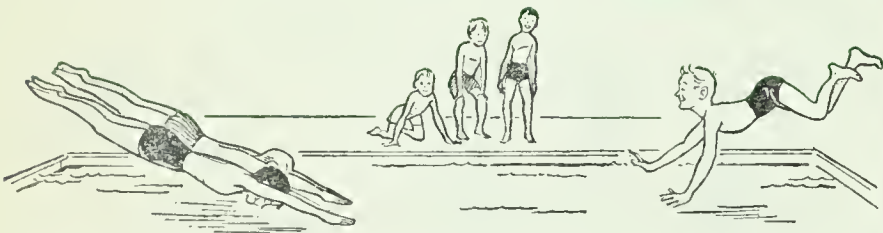




19. We were going to visit my cousin who lives in the city. She said we must take a bus marked "10." Put an X on the bus we will take for our visit.



20. Bees, sparrows, robins, and owls fly through the air. Frogs, turtles, and snakes do not fly. Find a picture of something that does not fly through the air. Put an X on it.



21. The swimming lesson was about to begin. The class was lined up. "Keep your head down as you enter the water," said the teacher. "Do not hold your head up." Draw a line under the picture of the way the children were told to enter the water.



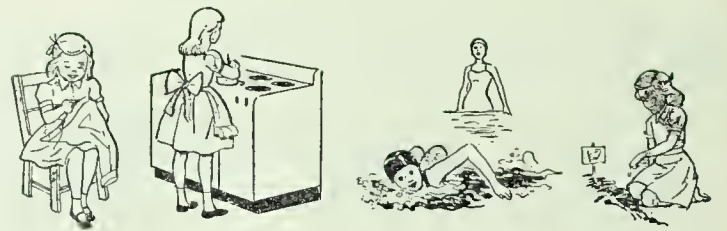
22. The girls are going to a birthday party. They are wearing their very best dresses. Each one is carrying a gift. Draw a line around the gifts they are taking to the party.



23. The little girl at the pet store window had always wanted a puppy. "Today is your birthday," said Mother. "You may choose a pet for your present." Draw a line from the girl to the pet she had always wanted.



24. The children were planning to go for a row. They are now in the boat. They will need two things to row with. Put an X on them.



25. My sister is learning to sew. She is using a needle and thread. "Take a short thread," said Mother. Put an X on the picture which shows what sister is learning to do.



26. The king and queen are going on a trip. Their children will go with them in a closed carriage. Three servants will follow in an open carriage. Put an X on the carriage in which the servants will travel.

# SURVEY OF PRIMARY READING DEVELOPMENT

*J. Richard Harsh & Dorothy Soeberg*

## FORM A-1

Name \_\_\_\_\_ Sex \_\_\_\_\_

School \_\_\_\_\_ Grade \_\_\_\_\_ Teacher \_\_\_\_\_

	Year	Month	Day
<i>Date Tested</i>	_____	_____	_____
<i>Birth Date</i>	_____	_____	_____
<i>Age</i>	_____	_____	_____

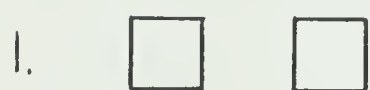
	Maximum Score	Obtained Score
I <i>Form Comparison</i>	12	_____
II <i>Word Form Comparison</i>	14	_____
III <i>Word Recognition</i>	17	_____
IV <i>Sentence Recognition</i>	8	_____
V <i>Sentence Comprehension</i>	9	_____
VI <i>Story Comprehension</i>	28	_____
<i>Total Score</i>	88	_____

### RANGE OF SCORES & DESCRIPTIVE LEVELS OF READING DEVELOPMENT

Total Score	<b>84-88</b>	<i>Comprehension by fact and inference</i>
	<b>75-83</b>	<i>Comprehension directly stated fact</i>
	<b>60-74</b>	<i>Use and meaning of words in content</i>
	<b>45-59</b>	<i>Basic vocabulary and use of vocabulary in sentences</i>
	<b>33-44</b>	<i>Beginning sight vocabulary</i>
	<b>0-32</b>	<i>Pre-reading form comparison level</i>

# I. Form Comparison

A	○	+
B	◡	◡





II. Word Form Comparison

A.	Go	Go
B.	sleep	see

1.	Mother	Mother
2.	baby	play
3.	Here	Help
4.	little	little
5.	and	said
6.	down	down
7.	on	no

8.	was	saw
9.	want	want
10.	look	book
11.	Daddy	Puppy
12.	something	something
13.	doll	ball
14.	red	bed

### III. Word Recognition

A.    baby                      see                      Father                      down

B.    come                      I                      here                      little

---

1.    run                      go                      up                      look

2.    good                      game                      Stop                      go

3.    and                      made                      are                      said

4.    like                      little                      big                      something

5.    help                      back                      here                      sleep

6.    two                      three                      tree                      number

7.    bed                      said                      red                      road



- |     |            |          |           |           |
|-----|------------|----------|-----------|-----------|
| 8.  | made       | room     | run       | work      |
| 9.  | from       | Baby     | barn      | farm      |
| 10. | read       | ride     | road      | room      |
| 11. | draw       | Paint    | color     | Clay      |
| 12. | home       | have     | house     | happy     |
| 13. | will       | want     | went      | what      |
| 14. | farmer     | the      | truck     | machine   |
| 15. | candy      | cartoon  | carrot    | carry     |
| 16. | someone    | sunlight | standing  | something |
| 17. | everything | tomorrow | yesterday | today     |

Test III

Number of Errors \_\_\_\_\_ Score \_\_\_\_\_

#### IV. Sentence Recognition

A. Come and play.

Look at me.

See the airplane.

---

1. I can run.

I see a ball.

I see a yellow cat.

---

2. Look at Susan.

Look at the book.

Look look look.

---

3. It is funny.

It is Father.

It can go.

4. We like to play.

We like to plant.

We like to paint.

---

5. The dog can run fast.

Father can run to the car.

Run and play with the dog.

---

6. My boat is red.

Milk is good to drink.

Make a big red boat.

---

7. Water makes our garden grow.

We watch our garden grow.

The sun makes our garden grow.

---

8. The book is on the table.

This barn is over the hill.

The boys are in the tent.

Test VI

Number of Errors \_\_\_\_\_ Score \_\_\_\_\_

V. Sentence Comprehension

A.

Bill is a

house

tree

boy

1.

I can

run

green

house

2.

We like to

funny

good

play

3.

See the airplane go

red and blue

up and down

run and walk

4.

The dog has

one

two

three

eyes.

5.

I like to drink

make

clay

milk

6.

mother

My

games

wants me to come home.

something

7.

Start

Run

before you cross the street.

Stop

8.

Paint

Close

the window blue and white.

Open

9.

waiting

Mary is

wanting

to her friend's house.

walking

Test V

Number of Errors \_\_\_\_\_ Score \_\_\_\_\_



Dick and Susan

The boy is Dick.

The girl is Susan.

Dick and Susan play with the ball.

---

- A. Dick is playing ball.
- B. Mother is playing ball.
- C. Susan is a girl.

## A Trip To The Farm

We went to the farm.

We saw the cows.

The cows were black and white.

We had a good time.

- 
1. We went to the circus.
  2. The cows were on the farm.
  3. There were black and white cows.
  4. We fed the cows.



## Our School

The boys and girls go to school.

They like to read and paint.

They play games.

They have a good time.

The building is painted red.

- 
5. Father goes to school.
  6. The boys and girls like to paint.
  7. The cows play games.
  8. The school building is red.
  9. The name of the story is "Your School."

## The Garden

We have a garden.

We planted radish seeds.

We water them each day.

Our class will eat the radishes.

- 
10. The farmer has a radish garden.
  11. The boys and girls will eat corn.
  12. Daddy waters the radishes.
  13. The children are going to eat the radishes.
  14. The name of the story is "The Radish."

## The Funny Dog

Mother and I like to see the funny dog play in the yard. Daddy makes the dog run after the ball. We like to have the dog in our house. The dog likes to play with the children.

- 
15. The dog was hungry.
  16. Daddy made the dog run.
  17. We don't let the dog come in our house.
  18. The dog likes to play with the sun.
  19. Daddy throws the ball to make the dog run.

## The House Burned

Yesterday a house caught on fire. Jack and Tom were playing football when they saw smoke down the street. A policeman called the fire department. Just as the roof burst into flames the fire engine came around the corner. The firemen unloaded the hose and connected it to the fire plug. Some of the firemen put ladders up to the roof. The lady who lived in the house was not at home when the fire started. She came running down the street and saw the firemen put out the fire.

- 
20. Jack and Tom helped the firemen unload the hose.
  21. The boys were sad because the football burned.
  22. The lady was not in the house when it caught fire.
  23. A policeman came on the fire truck.
  24. The fire engine arrived when the roof started burning.
  25. No one knew who lived in the house.
  26. The house burned down.
  27. Tom's mother called the fire department.
  28. The firemen got the water from the fire plug.





# DETROIT BEGINNING FIRST-GRADE INTELLIGENCE TEST

(Revised)

By ANNA M. ENGEL, Assistant Director, Special Education, Detroit Public Schools,  
and HARRY J. BAKER, Director Psychological Clinic, Detroit Public Schools

No. OF TEST	SCORE
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
Total	

Last name..... First name..... Initial... Sex: M...F...

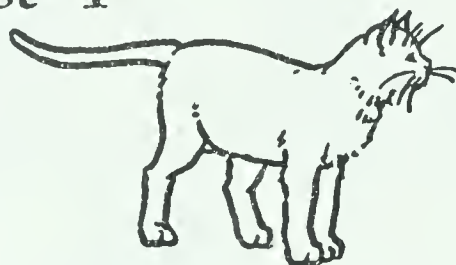
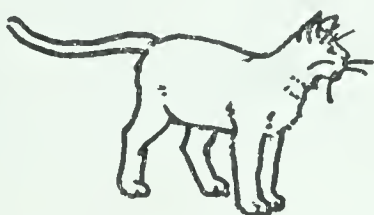
City..... School..... Birth date.....

Rating..... Mental Age..... IQ.....

## EXAMINATION: FORM A

A

### Test 1



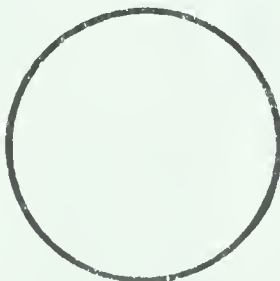
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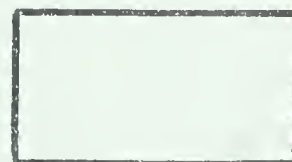
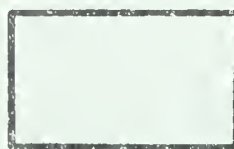
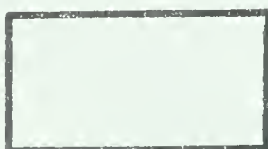
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3



4



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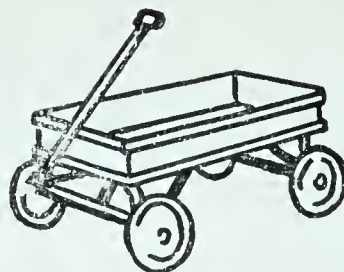
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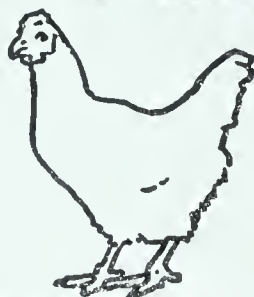
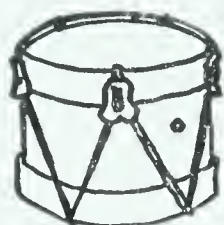
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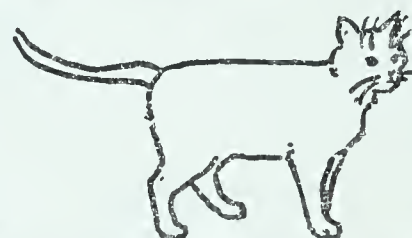
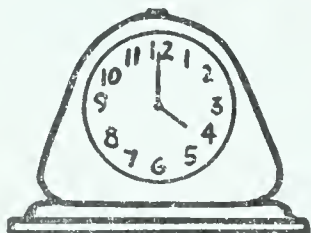
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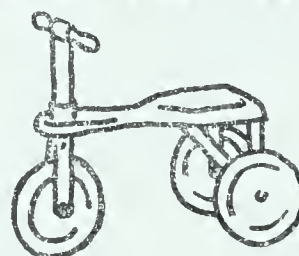
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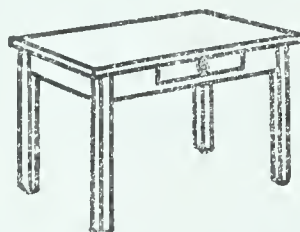
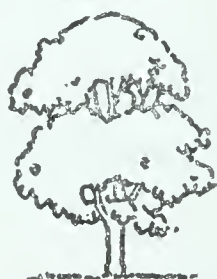
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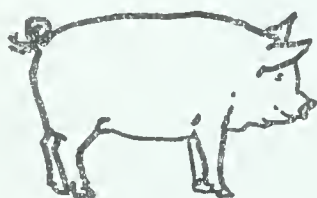
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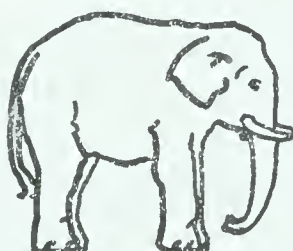
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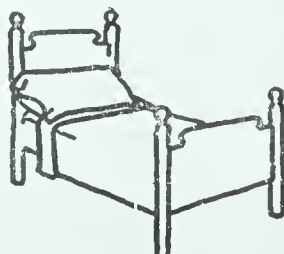
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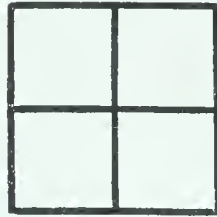
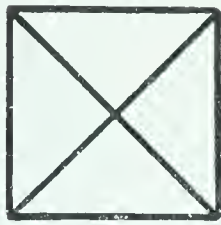
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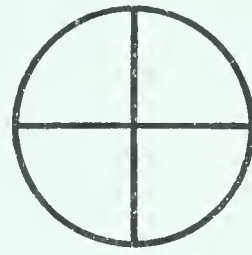
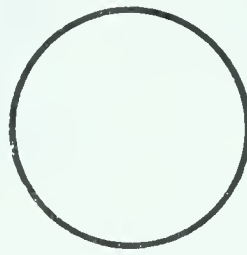


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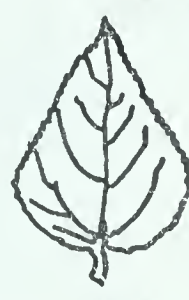
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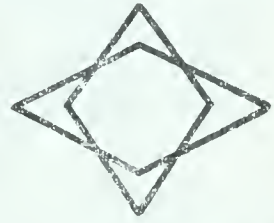
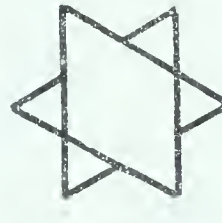
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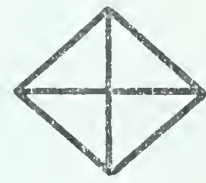
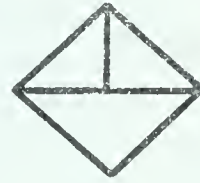
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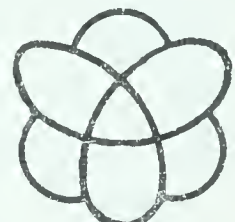
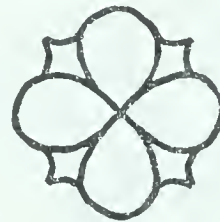
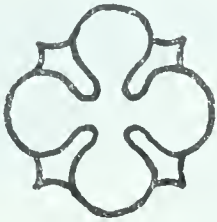
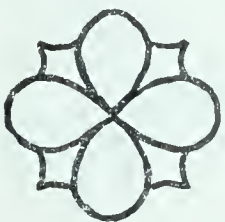
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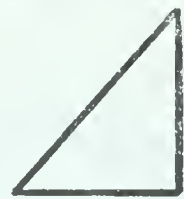
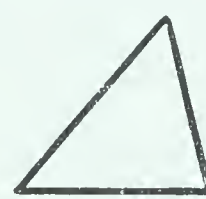
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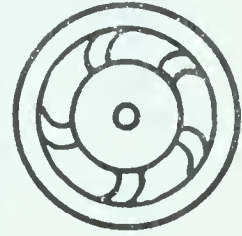
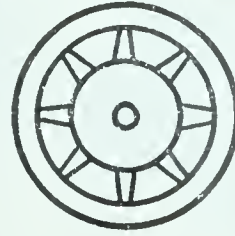
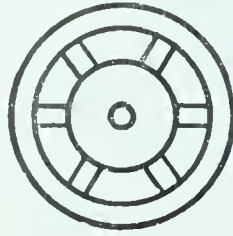
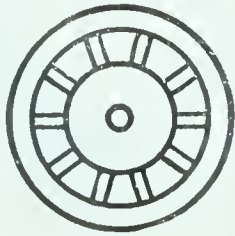
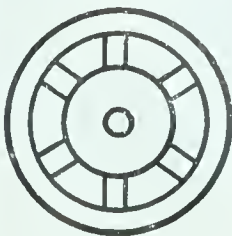
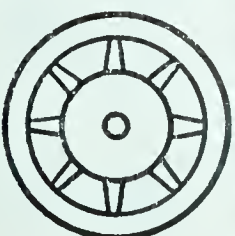
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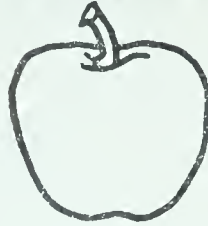
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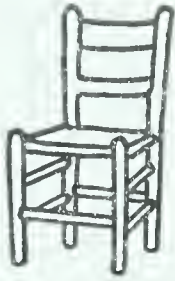


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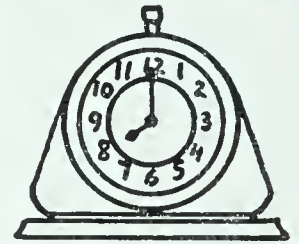
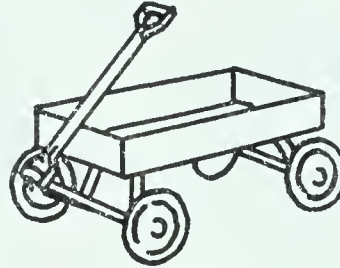
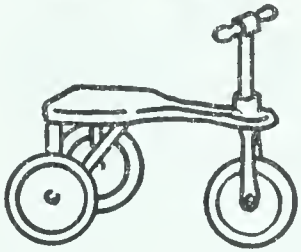
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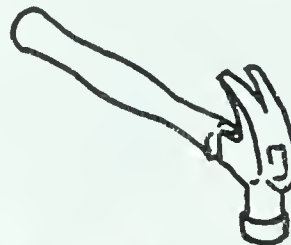
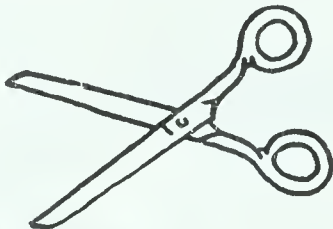
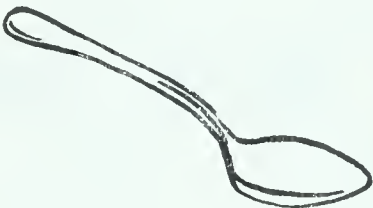
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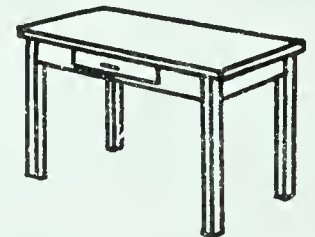
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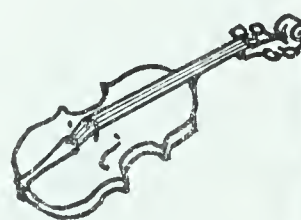
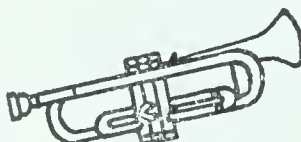
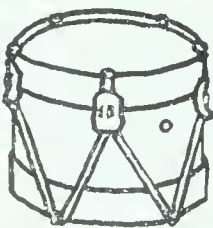
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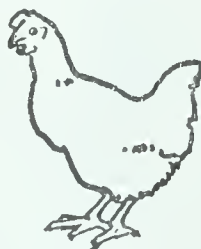
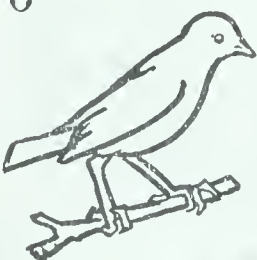
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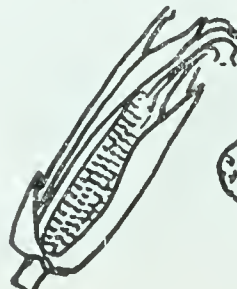
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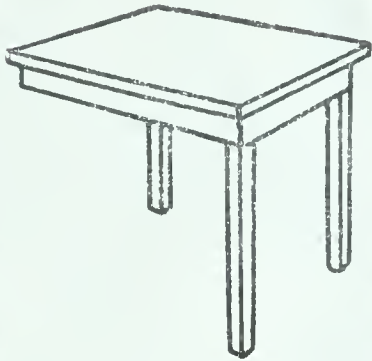


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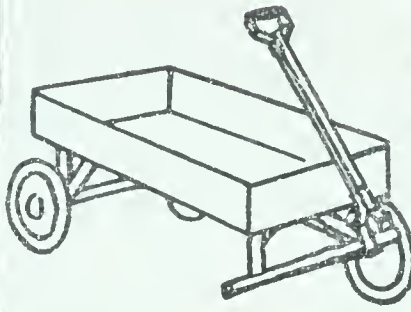
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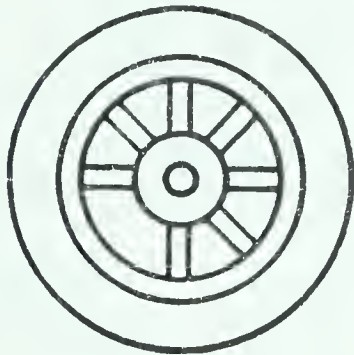
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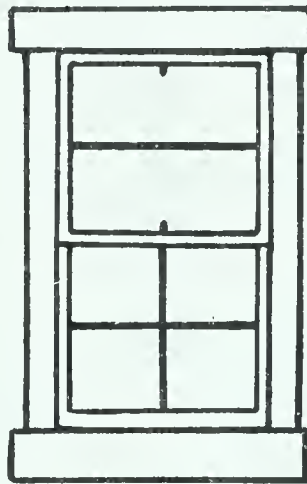
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Score .....

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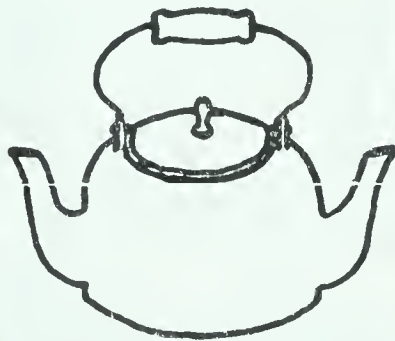
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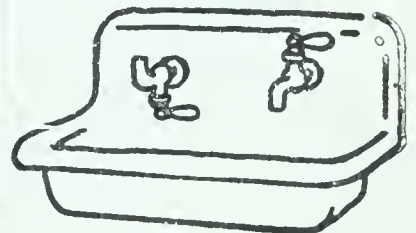
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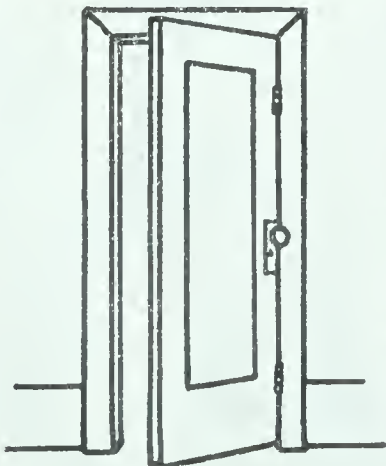
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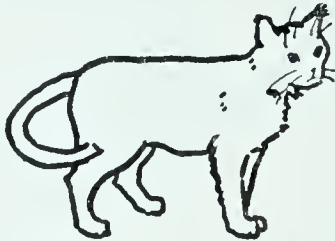
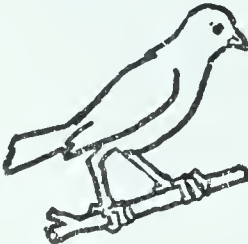


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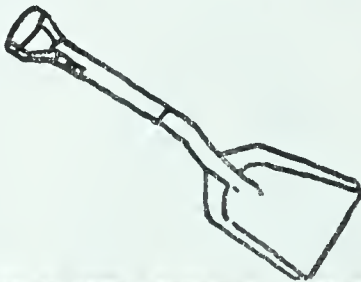
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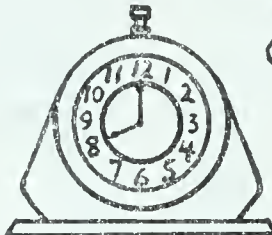
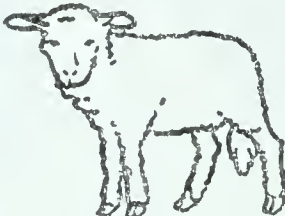
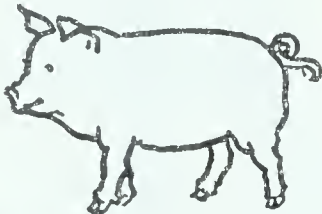
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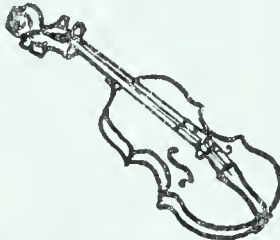
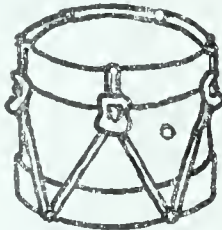
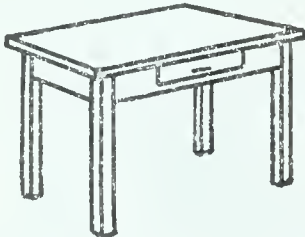
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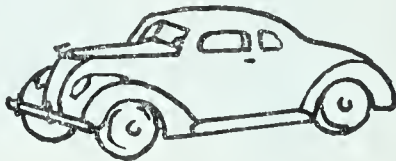
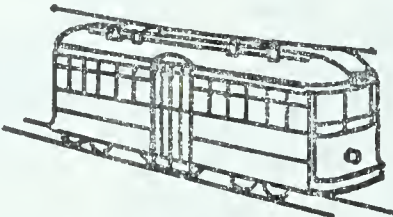
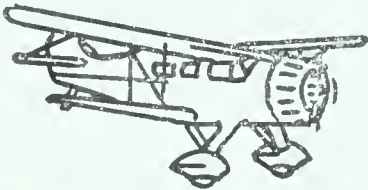
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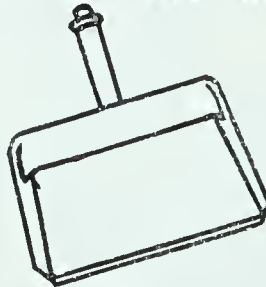
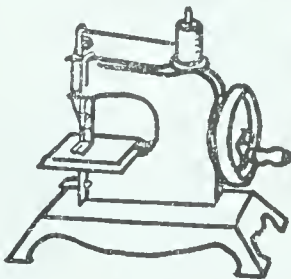
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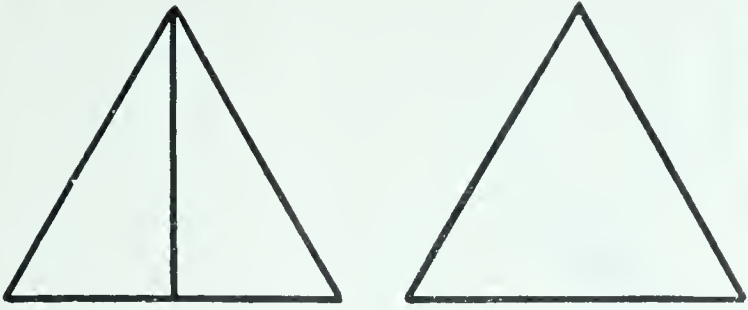


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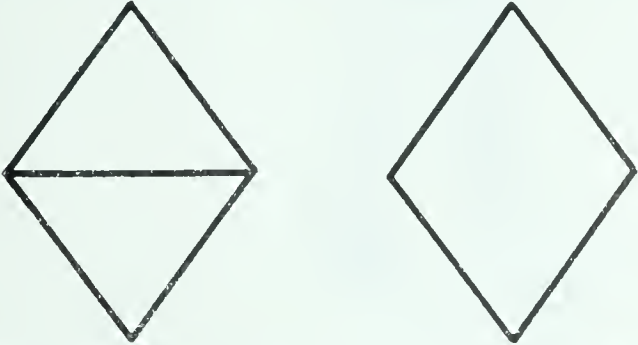


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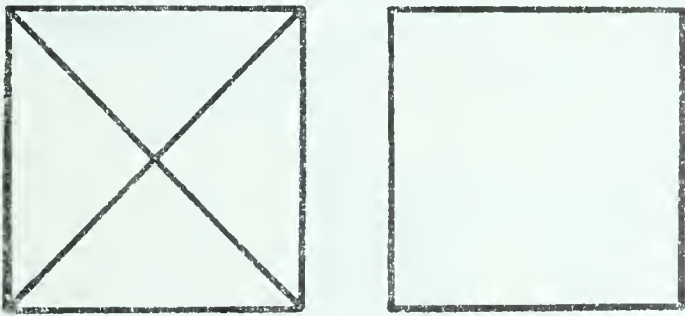
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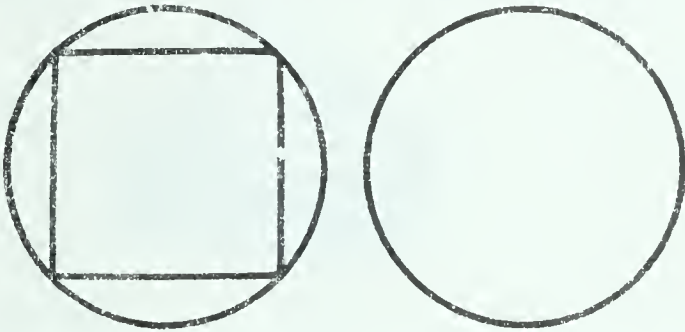
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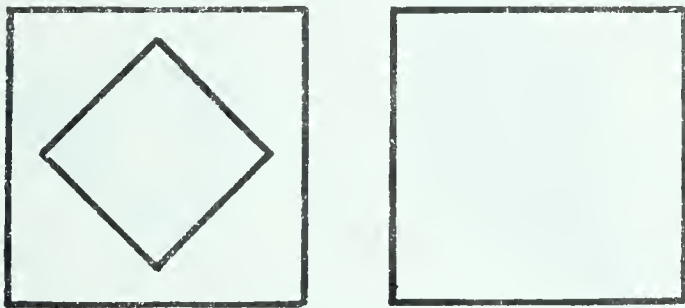
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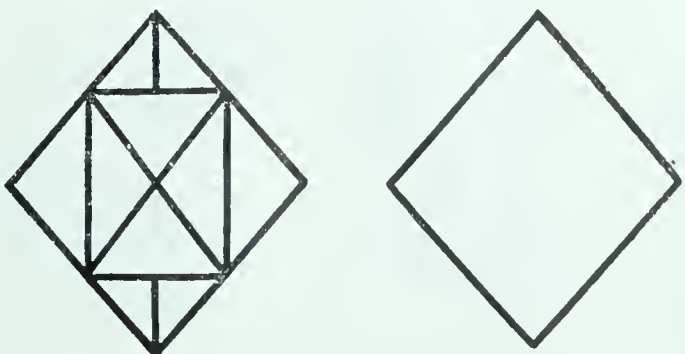
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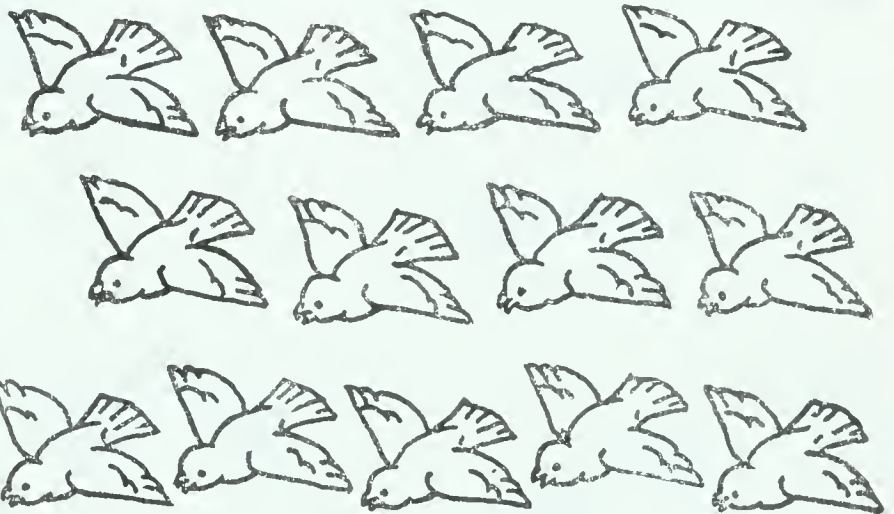
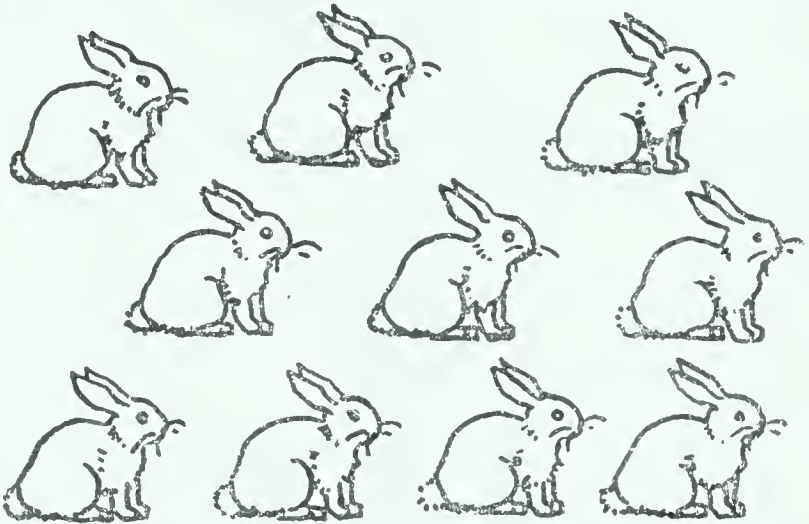
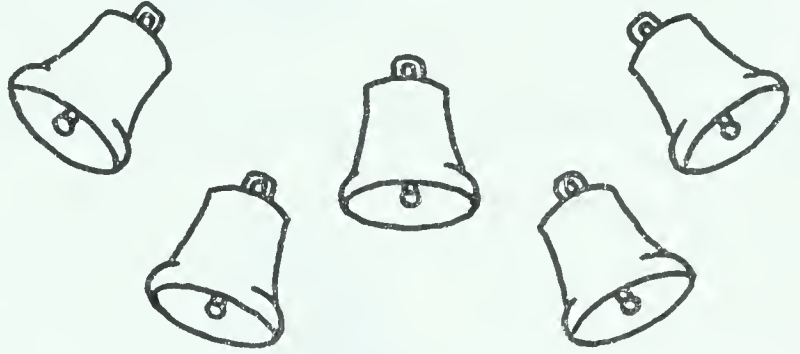


5



Score ..... [ 7 ]

# Test 9

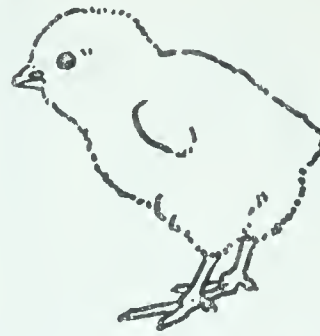


Score .....



# Test 10

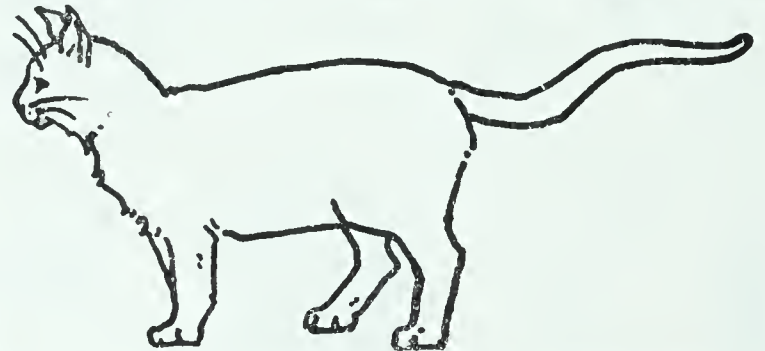
A



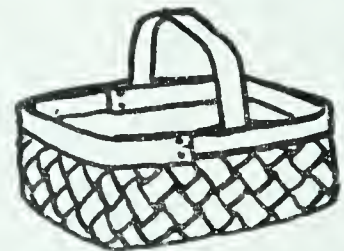
1



2



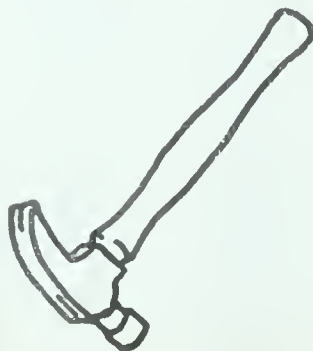
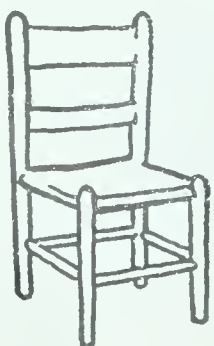
3



4



5











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